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Strategic expansion of a platform ecosystem originating in the telecommunications industry – design science research

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In recent years, many established companies have been trying to implement platform business models in the hope of achieving similar success as the platform leaders such as Amazon and Apple. The platform leaders have been successful in forging platform ecosystems by attracting various participants to their platforms, such as the Amazon marketplace and Apple iOS, and have simultaneously set themselves in a lucrative position to collect rents from them. This thesis is conducted from the perspective of a global technology company, which aims to expand the ecosystem around a technology platform, which is currently only leveraged within the company in serving its customers. The platform originates in the telecommunications industry, and it integrates analytics, virtualization and automation in order to help communications service providers with their increasing costs and dwindling revenues.

The design science research methodology was chosen for the study as the topic of exploring expansion opportunities for a platform ecosystem in a real-world context is clearly forward-looking in nature. The methodology allows for the creation of practical artifacts, platform ecosystem models in this case, which the company could implement. An extensive literature review was conducted to provide a solid background for the empirical part of the study with a focus on the platform economy, ecosystems and relevant technical topics. The empirical part of the study focused on exploring the specific context and designing interventions that would allow overcoming identified challenges in the context. Additionally, the potential beneficial outcomes of the interventions, as well as the mechanisms of reaching those outcomes, were studied. The data for the empirical part of the study was collected by interviewing employees of the focal company, representatives of potential ecosystem partner companies and external industry experts.

The thesis resulted in the design of three platform ecosystem models. The models result from either one or both of the two following interventions. Intervention 1 proposes the involvement of development partners to the development of the applications to the platform, called complementary content in this thesis, while intervention 2 proposes involving sales partners in the ecosystem and creating a sales portal or a digital marketplace for the complementary content. The research provides a detailed understanding of the potential beneficial outcomes of the interventions and also describes the mechanisms for reaching them. This thesis presents valuable insight to the decision-makers of the focal company but also to practicing professionals outside the company who are looking into opportunities to expand their platform ecosystems. Academically this thesis builds on the platform ecosystem literature and validates the use of design science research methodology in theses studying a strategic topic, such as the expansion of a platform ecosystem.

Keywords: platform economy, platform ecosystem, digital platform, design science

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Useat vakiintuneet yritykset ovat pyrkineet viime vuosina ottamaan käyttöön alustatalouden liiketoimintamalleja. Tässä tavoitteena on ollut saavuttaa samanlaista menestystä kuin Amazonin markkinapaikka tai Applen iOS, jotka ovat onnistuneet vetämään puoleensa useita eri toimijoita kyeten samalla asettumaan taloudellisesti kannattavaan asemaan, jossa ne voivat saada tuloja näiltä eri toimijoilta ekosysteemeissään. Tämä diplomityö on tehty globaalin teknologiayrityksen näkökulmasta, joka pyrkii laajentamaan ekosysteemiä erään teknologia-alustansa ympärillä. Tätä alustaa käytetään tällä hetkellä yrityksessä ainoastaan sisäisesti operaattoriasiakkaiden auttamiseen heidän nousevien kustannustensa sekä laskevien liikevaihtojensa kanssa. Alusta on lähtöisin telekommunikaatioalalta ja siinä yhdistyy analytiikka, virtualisaatio sekä automaatio.

Tutkimus toteutettiin suunnittelun kautta, koska työssä tutkitaan tulevaisuusorientoituneesti alustaekosysteemin laajentumismahdollisuuksia tosielämän kontekstissa. Suunnittelun kautta toteutettava tutkimus mahdollistaa kohdeyritykselle käyttökelpoisten artefaktien luomisen, jotka ovat tässä tapauksessa alustaekosysteemimalleja. Työn empiiristä osaa tukemaan toteutettiin laaja kirjallisuuskatsaus, jossa keskityttiin alustatalouteen, ekosysteemeihin sekä olennaisiin teknologisiin aiheisiin. Empiirisessä osassa keskityttiin tutkimaan kyseessä olevan alustan kontekstia ja määrittämään siihen perustuen interventioita, jotka mahdollistavat esille nousseiden haasteiden ratkaisemisen. Tämän lisäksi tutkittiin interventioiden hyödyllisiä seurauksia ja niiden saavuttamiseen vaadittavia mekanismeja. Empiirisen osan aineisto kerättiin haastattelemalla kohdeyrityksen työntekijöitä, mahdollisten ekosysteemikumppaniyritysten edustajia sekä yrityksen ulkopuolisia toimialaeksperttejä.

Työn tuloksena syntyi kolme alustaekosysteemimallia, joissa toteutetaan joko yksi tai molemmat esitetyistä interventioista. Interventiossa 1 alustaekosysteemiin sisällytettäisiin sovelluskehittäjäkumppaneita. Interventiossa 2 mukaan otettaisiin myyntikumppaneita ja luotaisiin myyntiportaali tai markkinapaikka alustalla toimiville sovelluksille. Tutkimus tarjoaa yksityiskohtaista tietoa näiden interventioiden hyödyllisistä seurauksista sekä niistä mekanismeista, joilla ne voidaan saavuttaa. Kohdeyrityksen päätöksentekijöille tämä työ tarjoaa arvokasta ymmärrystä tutkitun alustan tulevaisuutta varten. Myös yrityksen ulkopuoliset ammattilaiset voivat hyötyä työn tuloksista pohtiessaan mahdollisuuksiaan laajentaa alustaekosysteemejään. Akateemisesti katsoen tämä tutkimus lisää ymmärrystä alustaekosysteemeistä. Lisäksi työ vahvistaa suunnittelun kautta toteutettavan tutkimuksen toimivuuden diplomitöissä, joissa tutkitaan strategisia aiheita, kuten alustaekosysteemin laajentamista.

Avainsanat: alustalous, alustaekosysteemit, digitaalinen alusta, tutkimus suunnittelun kautta

Julkaisukieli: englanti

Preface

I am grateful for the opportunity to write my thesis on such an intriguing and relevant topic. The topic and the context of the thesis were exactly what I hoped for, as they allowed me to dive deeper into the study of platforms, contribute to the academic literature and also provide practical insight to the company who commissioned the thesis. As the thesis was forward-looking in nature and focused on a real-world platform ecosystem, a suitable opportunity emerged to conduct the first strategy thesis in Aalto IEM to employ the design science research methodology (DSRM). It was a positive challenge that I embraced with curiosity and eagerness. Hopefully this thesis will also encourage others to apply the methodology in their theses.

None of this would have been possible without the support from the amazing people around me. First of all, I wish to thank my advisors and superiors Dennis and Morena from the company for the opportunity to conduct the thesis and for their continuing support throughout the spring. I also wish to thank every interviewee within and outside the company for taking the time and being willing to contribute to the thesis. There were also number of other people within the company, who contributed substantially to this work and I wish to thank all of you – you know who you are!

From the university, my academic supervisor Professor Robin Gustafsson deserves my highest gratitude for his magnificent support. Through your ideas and our discussions, I was always able to take the work forward in the moments of doubt and eventually refine the thesis to be as elaborate as it is today. I also wish to thank Professor Gustafsson for proposing the design science research methodology for the thesis, as it made the work even more interesting for me. I am also grateful to Professor Jan Holmström, who generously offered his expertise in applying the DSRM in the study.

Last but not least, I wish to thank my family and friends for always being there to support me on any challenge I may take on but also for reminding me that there is much more in life than only school and work. This is something I am prone to forget in the heat of the moment. I have so much to thank you for in making it possible for me write a thesis that I can be so proud of to complete my degree with!

Lasse Lappalainen

Espoo, June 2019

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1 Introduction

This thesis studies the strategic expansion of a platform ecosystem from a technology platform owner's perspective. The platform originates in the telecommunications industry, and the primary focus of the study is on exploring the opportunities of building an ecosystem of partners around it. This study is divided into theoretical and empirical parts. The theoretical part features an extensive literature review on characteristics of the platform economy, digital infrastructure and platforms, platform openness, platform and business ecosystem evolution and finally, platform adoption. The empirical part of the thesis examines the real-world situation of the technology platform and the opportunities to expand the platform ecosystem around it by involving partners. This is done through the design science research methodology, in which two interventions are proposed resulting in three proposals for platform ecosystem models. The empirical part is based on 20 interviews.

This first chapter is the introduction to the thesis. First, the background and motivation of the study are described. After that, the research problem, as well as the research questions, are defined, and then, the objectives and the scope of the study are discussed. Finally, the structure of the study is presented.

1.1 Background and motivation

Especially within the last decade we have witnessed the dominance in business shifting from companies who have employed more traditional, linear and hierarchical integrated supply chains, such as Exxon Mobil, to companies who are applying ecosystem-based multi-sided platform business models, such as Amazon (Eisenmann et al. 2011; Hagiu & Wright 2015; Pagani 2013). This shift has made established companies across the board to consider their possibilities to apply platform business principles around their core businesses (Moser et al. 2017), meaning that they would allow external parties to contribute to the development and commercialization of their platforms. Amazon realized this early on, when it transformed itself from a mere book re-seller to a retail marketplace, in which businesses could sell their products to consumers all around the world. Similarly, Amazon introduced AWS, which allowed it to exploit the enormous investment in its web-based digital platforms and infrastructure to a more

considerable extent, by also offering them as services to third parties (Ritala et al. 2014). The focal platform in this study is currently primarily leveraged only within the focal company. Similarly, to the Amazon example, the company is, however, considering opportunities to increase the utilization of the platform.

Just like Amazon with its various web-based platforms (Ritala et al. 2014), many others, such as MobilePay in the mobile payment industry (Staykova & Damsgaard 2015) and Scilab in the numerical computation market (Blondel & Edouard 2015), have been able to evolve their platforms over time to involve more sides or new features. These are not trivial endeavors for companies, who have conducted their business through more conventional, closed and supply-chain oriented means. While many of these companies might excel at designing internal platforms (Gawer 2014), such as the focal platform, they may lack the understanding of the means and requirements to attract partners and induce network effects to enlarge their business (Fu et al. 2018). The focal company has been operating with a more traditional, internally-focused approach with the business around the focal platform. Now the will to take the business around the platform further has brought up questions with the platform evolution. The focal company needs to understand the avenues for the evolution as well as the potential implications and requirements for building an ecosystem of partners to enhance the business around the platform.

The focal platform allows integration of automation, virtualization and analytics to provide customers with a range of different services. These services are currently primarily focused on serving the communications service providers (CSPs) in the telecommunications industry. The platform itself is an architecture that supports a collection of assets, thus making it a technology platform according to the platform categorization by Thomas et al. (2014). These assets are various software components that are highly integrated and accessible through platform workspaces. Each software component is dedicated to a specific task, such as analytics, database operations or visualization. The platform is employed in the development and utilization of applications, that can, for example, improve the availability of the CSP's network. These applications are complementary content in this thesis (Cennamo & Santalo 2013). The platform is a result of considerable commitment and investment from

the focal company, which has resulted in great success with customers and also earned praise from the analysts focusing on the industry, who claim it to be the leading platform in its field. Thus, the foundation for expanding the platform ecosystem and the business around the platform seems solid. This thesis explores the opportunities to expand the platform ecosystem as well as the potential outcomes and mechanisms of doing so by employing a design science research methodology (Peffers et al. 2007).

1.2 Research problem

The above-discussed background lays the foundation for the research problem of this thesis:

How to strategically expand a platform ecosystem originating in the telecommunications industry?

The design science research methodology is applied in order to address this forward-looking, real-world research problem effectively. This means that artifacts, in this case, platform ecosystem models, are designed based on the defined context and proposed interventions. The outcomes of the interventions and mechanisms of reaching them are also studied. The research problem can further be broken down into four research questions based on the CIMO logic – context, interventions, mechanisms and outcomes - that is commonly associated with the design science research methodology (Groop et al. 2017). Thus, more specific research questions are:

RQ1 – Context: Why should a change be considered to the current situation with the platform?
RQ2 – Interventions: How should the current situation be intervened to expand the platform ecosystem?
RQ3 – Beneficial outcomes: How could the focal company and end-customers benefit from the interventions?
RQ4 – Mechanisms: How can the beneficial outcomes of the interventions be reached?

The RQ1 aims to create an understanding of the current situation with the platform and especially shed light on the potential issues and limitations with it. These will provide a solid foundation to define interventions to the current situation, thus addressing the RQ2. The interventions themselves result in

the designed platform ecosystem models. The RQ3 concentrates on providing an understanding of how the interventions could benefit the focal company or the end-customers. Finally, the RQ4 examines the mechanisms through which the beneficial outcomes can be reached. The literature that is covered in chapter 2 will provide the theoretical foundation for addressing these research questions through the empirical part of the research.

1.3 Objectives and scope of the study

The objective of this study is to provide a thorough understanding of the opportunities to expand a platform ecosystem around a technology platform originating in the telecommunications industry. The aim is to understand the current situation with the platform and the issues with it, propose interventions to change the situation, understand the potential beneficial outcomes of those interventions as well as drill down to the mechanisms and requirements to carry out the interventions successfully.

The theoretical objectives of the thesis are twofold. First, the aim is to provide a comprehensive view of the existing literature relevant to the topic. More specifically, the covered themes in the literature review are the characteristics of the platform economy, digital infrastructure and platforms, platform openness, platform and business ecosystem evolution and finally, platform adoption. This provides both an understanding of the current state of the research on the areas that relate to the topic as well as a solid foundation to approach the empirical part of the study. Second, through the empirical part, the thesis contributes itself to the academic literature on platforms and platform ecosystems. The studies on platform ecosystems are still primarily exploratory, as noted by Fu et al. (2018) in their literature review covering 187 articles on platforms. This suggests that the field of study is not yet mature enough to shift towards confirmatory research methodologies. Thus, this thesis aims to increase the maturity of the platform ecosystem literature through exploratory design science research. Additionally, the aim is to confirm the feasibility of the design science research methodology in a thesis research that studies strategic platform ecosystem expansion.

There are also two practical objectives for the thesis. First, the thesis aims to provide the focal company with an understanding of how they could expand the platform ecosystem. This is done by applying design science research methodology in providing potential interventions as well as an understanding of their possible beneficial outcomes and mechanisms on how to achieve them. In concrete terms, these translate into the designed artifacts, the platform ecosystem models in this case. This will hopefully help the focal company with the platform's evolution in the future. Second, in addition to the focal company, the thesis aims to provide practical knowledge to practicing professionals even outside the company. Even though the study concentrates on a particular case, many companies can find themselves in a similar situation and can leverage some of the findings in navigating forward with their business.

While the research questions form a rather ambitious scope for the study, the setting of only concentrating on one platform ecosystem, retains the overall scope of the study at a reasonable level. This also allows appropriate depth to the analysis. Even though the primary focus is on the telecommunications industry, also the possibility of serving customers in adjacent industries, such as transportation, is present in the study. In the empirical part of the study, the data was collected by interviewing the employees of the focal company, representatives of potential ecosystem partner companies and external industry experts. Both more technically-oriented and more business-oriented people were interviewed to gain a holistic view, even though the study itself sits more firmly in the business context.

1.4 Structure of the study

This thesis is divided into five parts: (1) introduction, (2) theory, (3) methodology, (4) findings and (5) discussion. The theory chapter presents the literature relevant to the topic, whereas the methodology chapter describes the research methodology applied in the thesis. The findings chapter explains the empirical findings of the study and finally, the discussion chapter concentrates on the practical and theoretical implications of the study as well as discusses the limitations.

2 Theory

In this chapter, the theoretical background for the relevant topics is discussed through a literature review. The primary industry for the focal company and the platform is currently the telecommunications. The main customers are the communications service providers (CSPs) for both the company as a whole as well as for the services enabled by the focal platform and the complementary content atop of it. The company has an end-to-end portfolio in the telecommunications industry, ranging from network infrastructure to the various services, such as managing, operating and optimizing those networks. The focal company and its competitors are facing a problematic situation as their primary customers, the CSPs, are experiencing difficulties related to both revenue and costs. The enormous increases in network traffic caused by the rising number of devices with access to the internet combined with the content-rich multimedia and cloud applications, drive up both the OPEX and CAPEX of the CSPs (Hernandez-Valencia et al. 2015; Mijumbi et al. 2016; Samdanis et al. 2016). The infrastructure costs are a result of having to invest more in the networks to build up sufficient capacity, while the operational costs rise as a result of a more extensive network to maintain. Simultaneously, the CSPs are facing an issue with dwindling revenues, which are a result of stagnating growth of mobile subscribers especially in mature markets, such as Western Europe (Ghezzi et al. 2015), and the intensifying competition from both the other CSPs and the over-the-top service providers (Mijumbi et al. 2016), such as Skype or WhatsApp. Thus, both the volume of mobile subscriptions and the price per subscription are under pressure.

The CSPs are taking measures to affect both the costs and revenue. The network function virtualization (NFV) is considered a central technology in helping in that. It decouples the network functions from the physical equipment and enables the handling of the functions through software that runs on general-purpose hardware (Gil-herrera & Botero 2016). The network function virtualization and the automation it enables are central approaches to reducing the OPEX since the maintenance and updates for the networks and the networks software could be conducted remotely and at scale (Hernandez-Valencia et al. 2015; Mijumbi et al. 2016). The CAPEX reductions are primarily expected to result from improving the user traffic capacity of the existing networks through the network function virtualization and analytics (Mijumbi et al. 2016). Finally, new avenues for revenue could include selling the insights from

the CSP's subscribers' movements to, for example, public transportation companies to improve their routes. The focal platform integrates analytics, virtualization and automation, and provides a foundation to help the CSPs in addressing all of the mentioned cost and revenue levers. However, it is important to note out that the focal platform is not only limited to the NFV, and can handle virtualization across the board, thus making it suitable for also other industries than the telecommunications. Applications developed and utilized on the platform, called complementary content in this thesis, can, for example, automate maintenance of the network, increase the network capacity through optimization or analyze and visualize movement patterns of mobile phone owners. The opportunities in the field are diverse and will only become more substantial with the emerging 5G networks (Agiwal et al. 2016). Thus, it is worthy of exploring opportunities in expanding the platform ecosystem.

This literature review will not further focus on the telecommunications industry, but instead aims to provide a background to relevant topics in the sense of platform ecosystem as the aim is to consider how it could be expanded by involving partners to it. First, section 2.1 concentrates on the multi-sided platforms and network effects. While the focal platform is currently a technological construct, bringing partners aboard, potentially on many sides, would change the business dynamics more towards a platform business model, which could have the potential for network effects to form. Second, the platform itself is inherently digital, and having a good understanding of the basic characteristics of digital platforms and infrastructure are essential in the study. Thus, section 2.2 covers digital platforms and infrastructure. Third, section 2.3 reviews the existing literature on platform openness, which is a central topic, in the consideration in involving partners into the business ecosystem around the platform. Fourth, section 2.4 provides background in the literature on platform evolution and ecosystems. This is a central topic as this thesis considers evolutionary direction for the focal platform ecosystem. Finally, platform adoption is covered in section 2.5. This covers the various factors that the previous research has found to impact the potential platform ecosystem participants decision on platform adoption. This is an essential topic as a platform ecosystem cannot be created without attracting ecosystem participants. Together these all form a solid foundation for the empirical part of the thesis.

2.1 Multisided platforms and network effects

Platforms, in general, have already been studied for decades and within particular disciplines, such as industrial innovation management and economics, key fundamental assumptions are, to a certain degree, becoming formalized. However, the increasing reach of the platform economy to new industries featuring novel business models constantly brings up the need for further research. (Reuver et al. 2017)

A large share of the platform literature concentrates on multi-sided platforms (MSPs), which the internal platforms or supply-chain platforms do not represent (Reuver et al. 2017) as they are not necessarily enabling interaction between various external parties. Hagiu and Wright (2015) compare multi-sided platforms with different business models, such as the vertically integrated firm, whose product or service could, in certain circumstances, be considered to be an internal platform. Additionally, products or services of companies acting as assemblers of goods and services from the inputs of their suppliers could be considered to be supply-chain platforms. These two along with a reseller business model are considered traditional and linear, in which one player receives inputs from another, transforms them, and sells the output, whereas the MSP business model, on the other hand, is triangular (Eisenmann et al. 2011; Hagiu & Wright 2015).

Hagiu and Wright (2015) claim that MSPs have two fundamental features that set them apart from other business models. First, they make it possible for two or more distinct sides to interact directly. This means that two or more sides preserve control over the key terms of interaction without the intermediary defining them. The key terms could, for example, be pricing and delivery of the goods or services offered, if the interaction involves trading. Second, there is an affiliation with the platform for each of the sides. The “affiliation” means that different user sides deliberately conduct platform-specific investments that allow them to interact with each other directly. This investment can be made in many different ways, such as buying an iPhone to access the App Store or spending time on learning to develop applications to the App Store through iPhone's APIs. (Hagiu & Wright 2015)

The interactions between different sides in MSPs create and are subject to so-called network effects, which can also be called network externalities (Eisenmann et al. 2011; Parker & Alstyne 2005; Reuver et al. 2017; Rochet & Tirole 2003). Network externalities suggest that the usefulness of a technology increases as the number of users grows (Katz & Shapiro 1985). These network effects can be direct (same-side) or indirect (cross-side). They are direct if the value of the platform derives from the number of users in the same user side. An example of direct network effects can be seen in the social media platforms, where the value to end-users increases as the number of end-users in the platform increases. On the other hand, network effects are indirect if the value of the platform depends on the number of users on different sides of the platform. In the social media example, indirect network effects would represent the increased value to, for example, advertisers when the number of end-users increases. Both direct and indirect network effects can also be negative. An example of negative direct network effects would be the decreasing value of a mobile phone application marketplace for a developer when the competition increases with a growing number of developers. (Eisenmann et al. 2011; Hagiu & Wright 2015)

A large share of the platform literature concentrates on platforms, where at least one side is directly represented by consumers, likely due to the enormous success and visibility of many such platforms. The vast number of potential platform participants has played a significant role in fostering their success. These types of platforms are often noted as B2C or C2C platforms (Chen et al. 2009; Li et al. 2013). This creates potential for sizable network effects, described above, that are in the heart of a successful platform business. For example, Amazon has been able to create a very successful B2C business with its retail marketplace, in which businesses selling various products can reach consumers around the globe (Ritala et al. 2014). eBay, on the other hand, enables consumers to trade merchandise between each other and is thus a C2C e-commerce platform (Chen et al. 2009). However, the scope of this study sits firmly in the B2B realm, since at least for the foreseeable future all of the potential partners and customers would be businesses.

Business-to-business (B2B) platforms allow interaction and transactions between suppliers of services or products, and their customers (Li & Penard 2014). The platform itself provides the infrastructure to

facilitate the interaction (Chakravarty et al. 2014). This infrastructure could be, for example, request-for-quote mechanisms as well as platform mediated payments. B2B marketplaces can be vertical or horizontal, depending on the scope (Li & Penard 2014). Industry-specific platforms bring together suppliers of business services or products, and buyers in one industry, such as telecommunication. On the other hand, the horizontal B2B platforms operate in multiple industries connecting and serving players in various value chains. Also, the platform host can, in addition to running the platform, be a direct participant to the platform. The platform can be considered to be either biased or neutral based on the platform host's role (Yoo et al. 2007). In a biased platform, the host itself also participates directly at one side of the platform, thus, for example, bringing substituting first-party content (Hagiu & Spulber 2013) to the platform on the supplier side. This could also well be considered partial vertical integration from the platform host's end (Hagiu & Wright 2015). The neutral platform, on the other hand, is hosted by a third-party, whom itself does not directly act as a seller or buyer in the platform.

Additionally, Li and Penard (2014) propose that a typical feature to many B2B platforms, especially marketplaces, is the reverse auction mechanism in the interaction between buyers and sellers. In contrast to, for example, traditional eBay auction, in which the seller posts an item to the platform and the highest bidder wins, in the reversed model the buyer of a product or service posts a request for a quote (RFQ) to the platform in order to obtain input from the sellers. The sellers on their turn respond to the request with their offers, from which the buyer can then pick the best suiting alternative. The reverse auction model allows cost savings for buyers through increased price competition as well as potentially less time consuming and more convenient purchasing processes as the sellers can be accessed through one single request for a quote (Anandalingam et al. 2005). On the other hand, the sellers in their turn could enjoy the opportunity to access new customers as well as may be able to cut down some marketing efforts. One of the downsides is the concentrated competition in the platform. However, for example, in some instances of a platform hosting open-source software marketplace (August et al. 2018), the higher the participation and activity in the seller side the faster the innovation rate can be and new avenues for value creation and capture may emerge being of benefit for both the sellers and the buyers in the platform.

2.2 Digital platforms and infrastructure

The focal platform in the study is inherently digital regarding the inputs and outputs of the services enabled by the platform and the applications that are developed and utilized with it, even though some of the cases are related to the improvement of physical network assets. The dominating platforms of today are either purely digital, such as Facebook, or they offer digital means to exchange and use physical artifacts or services, such as car rides through Uber. Digital platforms are based on digital assets, both software and data. Software is the application and code, and an example of a software-based digital platform is a mobile phone application store, such as Google Play Store. Data is text, images, video and audio, and an example of a data-based digital platform could be a content streaming site, such as Twitch. (Karhu et al. 2019) In their synthesis of digital artifacts, Kallinikos et al. (2013) claim that digital assets have four unique traits that inherently make them digital: editability, interactivity, openness and distributedness. These provide grounds to less centrally managed business models and significant scalability. Additionally, Yoo et al. (2010) argue that homogeneity is also characteristic for digital assets, enabling broad range collaboration through common technologies.

Digital infrastructure is built on digital assets and inherits its differences to traditional infrastructure from the unique traits of digital assets that Kallinikos et al. (2013) and Yoo et al. (2010) among others have generously described. Tilson et al. (2010) describe the three fundamental properties of digital infrastructure. First, digital infrastructure is recursively organized, leading to the possibility to generatively create new infrastructure atop of the existing (Henfridsson & Bygstad 2013; Tilson et al. 2010). This greatly differs from traditional infrastructure, such as water utilities, which do not allow new businesses to be effortlessly built atop of them. Henfridsson and Bygstad (2013) present three generative mechanisms for digital infrastructure evolution that can be well coupled with the three properties of digital infrastructure. First of the three, the innovation mechanism describes how the generativity relates to digital. The technical malleability of digital infrastructure leads to recursive recombination of technologies resulting in new services or products, such as application, developed atop of the infrastructure.

Second, the scalability of digital infrastructure is way beyond that of physical infrastructure. Updating and replacing different elements in the digital infrastructure is easy and inexpensive, which results in frequent innovation and leaps in technology. (Tilson et al. 2010) The second interlinking mechanism that Henfridsson and Bygstad (2013) propose is the adoption mechanism, which I would contribute to the scalability. In the adoption mechanism, new services or products attract new end-users, which results in higher investment and through that even more new services or products. This is also connected to the innovation mechanism, which further feeds the cycle.

Lastly, digital infrastructure provides both significant upstream and downstream flexibility increasing the scope of digital (Karhu et al. 2019; Tilson et al. 2010). Upward flexibility refers to the opportunities to develop applications atop of the lower-level capabilities of the digital infrastructure, whereas downward flexibility refers to the ability to run these higher-level applications on a range of lower-level layers in the digital infrastructure. The third mechanism from Henfridsson and Bygstad (2013) is the scaling mechanism, which can reach unprecedented speed in digital infrastructures. The digital infrastructure attracts partners, who add their new services or products atop of the infrastructure and thus, the reach of the infrastructure expands as the service or product portfolio grows. This, in turn, increases the scope also resulting in a potentially larger pool of end-users. The transmission of universally standard bits (Tilson et al. 2010) and the homogeneous nature of data (Yoo et al. 2010) in digital infrastructures are the backbone in enabling the special properties.

This thesis concentrates on a digital platform that represents a form of digital infrastructure. In the literature, digital platforms have various definitions ranging from purely technical artifacts where the platform acts as an extensible codebase to socio-technical assemblage consisting of technical elements in association with organizational processes and standards. (Reuver et al. 2017). Based on Tiwana et al. (2010), Ghazawneh and Henfridsson (2015) define digital platforms as: *"software-based external platforms consisting of the extensible codebase of a software-based system that provides core functionality shared by the modules that interoperate with it and the interfaces through which they interoperate."* This definition is sufficient for this paper as it concentrates mainly on software-based digital platforms. More specifically, the focal platform in the thesis could be considered to be a

technology platform by the categorization provided by (Thomas et al. 2014). They describe a technology platform to be: *"A system or architecture which supports a collection of complementary assets."* Thus, the definition of digital platform and technology platform are quite similar to each other, based on these two articles.

Digital platforms can feature applications developed to complement the platform core often by third-party developers (Tiwana et al. 2010). Ghazawneh and Henfridsson (2013) define applications as: *"executable pieces of software that are offered as applications, services or systems to the end-users of the platform."* These applications increase the platform's value as they serve different end-customer needs without inflicting direct development costs on the core platform (Ghazawneh & Henfridsson 2013; Ghazawneh & Henfridsson 2015). Additionally, the applications by third-party developers reduce the need from the platform core provider to innovate (Boudreau 2010; Parker & Alstyne 2018) and potentially leaving merely the attraction, governance and technological enablement of third-party developers to its responsibility. In the empirical part of the thesis, these applications on the platform are generally referred to as complementary content (Cennamo & Santalo 2013).

A digital platform can rely on cloud computing to provide different layers of the cloud stack to enable third-party developers to develop and run their applications on the platform. A typical setting of the cloud stack features four distinct layers: the hardware, infrastructure-as-a-service (IaaS), platform-as-a-service (PaaS) and software-as-a-service (SaaS) (Lenk et al. 2009). It is not necessary for a digital platform to produce each layer of the cloud stack in-house. There are many companies, such as Amazon Web Services and Microsoft, providing, for example, infrastructure-as-a-service. However, the more standard, off-the-shelf cloud stack a company relies on, the less differentiation it technologically allows.

The hardware layer consists of physical components, such as servers and switches, and it acts as the backbone of the cloud stack (Hu et al. 2011). The infrastructure-as-a-service layer channels the computational power and storage from the hardware to the above layers in the cloud stack (Hu et al. 2011). Practically this layer allows its users to run software applications without owning physical computers by delivering virtual servers as required or providing the ability to remotely store data (Tee

& Woodard 2013). The platform-as-a-service layer is primarily used by application developers to implement and distribute their applications in the cloud (Hu et al. 2011; Lenk et al. 2009). The platform layer provider also typically offers developers various tools or cloud services to work on the platform efficiently. These tools can include for example programming-language-level environment, predefined application programming interfaces (APIs) as well as software development kits (SDKs) (Hu et al. 2011; Karhu et al. 2018; Karhu et al. 2019). The software-as-a-service layer features all of the applications that run on the digital platform providing direct service to the end-users. (Lenk et al. 2009) This application layer in the cloud stack removes the need for end-users to install and run the software on their own devices (Hu et al. 2011), making it possible to run computing-heavy applications even on handheld devices that are connected to the cloud.

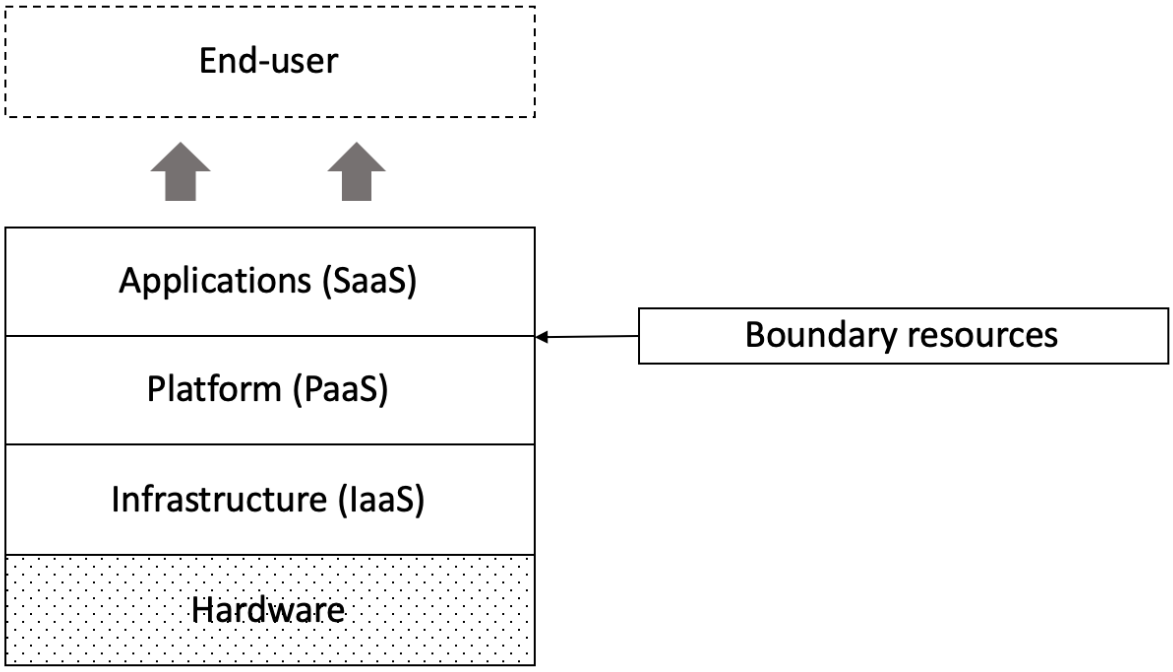

Figure 1, typical structure of a cloud stack

2.3 Platform Openness

The tools and cloud services offered to developers by the platform core provider and the interaction between these two have become essential in platform research. Ghazawneh and Henfridsson (2013) center their study of digital platforms to the boundary resources that facilitate the use of core platform

functionalities to develop applications in the interface between the platform and the third-party players, namely between the PaaS and SaaS layers. Boundary resources are software tools and regulations enabling the arm's-length relationship between the platform owner and the application developers. Examples of boundary resources could be the APIs and SDKs for the developers, distribution channels like application marketplaces, the application quality screening processes and the agreements that guide and restrict the developers work (Eaton et al. 2015; Ghazawneh & Henfridsson 2010; Ghazawneh & Henfridsson 2013). Karhu et al. (2018) build on West (2003) and also count the open-source licenses, through which core platform resources can be shared, to be boundary resources.

Ghazawneh and Henfridsson (2013) identify two key reasons for a platform owner to offer and continuously develop boundary resources. First, the boundary resources are aimed at further empowering the third-party developers' ability and will to enrich the platform with applications. In these cases, the platform is expected to benefit from the potentially increasing heterogeneity in knowledge resources (Yoo et al. 2010). The development of new boundary resources in these cases may be triggered by feedback from the developer community. Second, boundary resources can also be aimed at countering a control threat, that is emerging, for example, in the form of a third-party developer application. Eaton et al. (2015) further study the mechanisms of how boundary resources develop and claim that the role of a platform owner is not as all-encompassing as Ghazawneh and Henfridsson (2013) suggest. Instead, they claim that various actors, such as developers and end-users, participating in a platform collectively tune the boundary resources. Karhu et al. (2018), on the other hand, focus more on how the platform owner can control the openness of the platform through the use of boundary resources. Thus, boundary resources can be seen as means to both enable and control participation to a platform. Yet, it is vital to keep in mind that the platform owner should not be considered as the only force able to affect the development of the boundary resources.

Platform openness has to do with the easing of restrictions on the use, development and commercialization of platform technologies (Boudreau 2010). Thus, simply put, the easier it is for various participants, such as developers to operate on the platform, the higher the openness. Karhu et al. (2018) argue that there are two forms of openness leveraging boundary resources on digital

platforms. First, access openness means allowing external complementors, such as developers, to participate and conduct business on the platform. To enable this, the platform owner provides the participants with boundary resources that for example allow them to participate to the platform, for example through developing content, such as applications (Ghazawneh & Henfridsson 2015; Karhu et al. 2018), or offering other services through the platform. Second, resource openness refers to forfeiting of the IPR of the platform resources and thus opening them to external parties(Karhu et al. 2018; Parker & Alstyne 2018). Platform owners can, for example, open-source digital platform's codebase. Platform openness can be exercised by leveraging both forms of openness simultaneously, creating two forms of shared resources. The access openness results in, for example, applications that the developers share to the platform owner to distribute on the platform. In this case, the application is a shared resource over which the platform owner has restricted ownership along with the IPR of the platform resource. However, the platform IPR can as well be shared in the case of resource openness, creating shared IPR. (Karhu et al. 2018)

Companies may have different aims with both types of openness. First, companies may provide access to third parties in the hope of creating or empowering network effects on the platform (Parker & Alstyne 2005; Rochet & Tirole 2003). By providing access to complementors through APIs and such boundary resources, they can increase the number of complementors and the variety of applications that they provide, resulting in higher value for the platform (Karhu et al. 2019). The platform owner could extract a share of this value through various means such as revenue sharing or in-application advertisement (Karhu et al. 2018). However, increased openness can also create negative direct network effects on, for example, the developer side, where the competition might increase (Boudreau 2010; Parker et al. 2017).

Second, through access or resource openness, the platform owner may wish to externalize the innovation efforts (Boudreau 2010; Parker et al. 2017). Creating an extensive pool of third-party developers can significantly increase the speed of innovation, especially if the innovation itself is also handled as openly as possible (Parker & Alstyne 2018), meaning that other platform participants can also exploit innovation. In this kind of setting, not only the platform owner acts openly with the

developers, but the developers also share their resources with each other. However, Boudreau (2010) notes that opening platform technologies and having multiple contributors working in parallel might make it difficult to aim at a single objective. This challenge calls for institutional arrangements that promote coordination, accumulation and consolidation of the efforts from various contributors.

Third, the platform owner may aim at resource retrenchment by increasing resource openness (Alexy et al. 2018). By opening up certain IPR, the company can devolve the development responsibility to a broader pool of actors (Parker & Alstyne 2018). This obviously requires incentives for someone else to develop the now open resource further and simultaneously, the platform owner gives up control over the resource. However, the owner may be willing to do so, if it believes that it can reap more profits by concentrating its resources and development efforts on a complement rather than the resource itself. Devolving the control of the platform resource to third-party players might also incentivize them to seize the opportunity to reduce the platform owner's ability to reap profits from the developers' applications (Boudreau 2010). This kind of action from the platform owner's side could also create trust in the ecosystem leading to higher adoption. Additionally, some companies are willing to open up their resources in the hope of capturing even more valuable resources in return (Alexy et al. 2018). A technology platform may provide access or even open particular parts of the technology to external players, if that is the only way to, for example, gain particular analytics capabilities from external players. Thus, the rationale to provide access openness, resource openness or both might relate to the will to attract complementors in order to innovate, create network effects and gain access to resources that would not otherwise be available.

In the real world, there is a wide spectrum of different degrees of platform openness from entirely closed to purely open (Boudreau 2010). Closed platforms refer mainly to vertically integrated companies, who entirely control and own the internal platform's (Gawer 2014) technology without allowing access to any third-parties to participate in its development or production. On the other hand, entirely open platforms mean that there is no proprietary technology hindering anyone's access to the publicly shared core technology. This kind of technology would not either be controlled by anyone and would thus be free for everyone to use as they see fit.

Scholars have studied different ways of defining the degree of platform openness, that would enable, for example, comparing platforms with each other in this regard. Ghazawneh and Henfridsson (2015) discuss different levels of marketplace openness. The key factors defining the degree of openness are the equality of relationships between different platform players, the platform's openness to various types of applications and lastly the control it exerts to the environment, for example, through application review processes. Benlian et al. (2015) study the degree of openness of Android and iOS and take the complementor's, for example, developer's, perspective on defining the degree of platform openness. They develop a measure called perceived platform openness (PPO), which counts in the transparency and the accessibility of both the technical platform and the distribution channel, such as a marketplace. Ondrus et al. (2015) focus on the openness of mobile payment platforms. They evaluate the openness in three different dimensions: provider, technology and users. All these three examples have a different focus and take a slightly different approach in assessing the openness of the platform. This can be thought of as a positive feature since it only provides more dimensions through which the degree of openness can be analyzed in real-world situations.

It is important to understand different dimensions in platform openness in order to be able to consider the necessary factors in opening a platform by providing access and/or resources from the platform to third parties. The degree of platform openness can change over time and not only towards more open, but also to the other direction. Increasing openness can have positive, hoped results such as network effects, which can grow the participation to the platform, but it can also bring challenges in fronts such as quality and security. Thus, a thorough understanding of the potential consequences of altering openness must be created before action.

2.4 Platform and business ecosystem evolution

Ecosystems are highly related to platforms and whereas platform itself can evolve to, for example, involve more sides or new functionalities (Staykova & Damsgaard 2015), the business ecosystem around the platform can also evolve (Rong et al. 2013). Many companies in various industries are moving away from the hierarchical integrated supply chains to employ networks of strategic

partnerships with external parties (Pagani 2013). Adner (2017) provides a clear definition for the term ecosystem: "the alignment structure of the multilateral set of partners that need to interact in order for a focal value proposition to materialize." For example, Basole and Karla (2011) present the mobile platform ecosystems to consist of four groups of players: mobile device manufacturers, mobile network operators, mobile application developers and mobile platform providers. In this ecosystem, the mobile platform could be considered to be the keystone in the ecosystem, but the entire ecosystem and all of the mentioned players are necessary for the value proposition to the end-customer to materialize. The keystone (company) in the ecosystem improves its performance through collaboration with other players, while the collaboration also provides benefits to the partners in the ecosystem (Iansiti & Levien 2004).

The market entry of the platform can be considered to be among the first steps in its expansion and evolution. A considerable portion of platform market entry literature concentrates on how can new market entrants overcome the incumbent platforms (Fu et al. 2018). When discussing the market entry and the expansion of a platform, the network effects (Katz & Shapiro 1985) can play a central role as in many cases the value of the platform increases as the number of players in the relevant groups within the ecosystem grows. Especially if the platform's value relies heavily on the network effects, entering the markets can be difficult due to the catch-22 problem (Suarez & Kirtley 2012). This means that participants are not interested in the platform if there is not a sufficient number of representatives from other sides in the case of positive indirect network effects or enough of their peers in case of positive direct network effects. However, as an incumbent or first mover with a sizable installed-base or ecosystem, you are not necessarily protected against new entrants, even in markets where the network effects have significant importance. Zhu and Iansiti (2012) studied the importance of installed-base and the quality of the platform in terms of market entry. Their findings show that even a significant installed-base in a market with considerable indirect network effects does not protect incumbents if the market is quality-driven. However, if the market is driven by the installed base advantages or consumer expectations, then new entrants may have hard time overcoming the incumbents regardless of the quality. Thus, when customers are not highly forward-looking, for example, due to low switching costs, then a new entrant may be able to overcome an incumbent with superior quality. This is precisely

what Google did in the search engine market, when it took over Yahoo, with its superior search algorithms (Zhu & Iansiti 2012).

In more traditional markets, where the incumbents are not relying heavily on platform-based businesses and on the power of indirect network effects, an entrant employing a platform business model with an ecosystem may also be able to challenge the incumbent successfully. Blondel and Edouard (2015) concentrate on the numerical computation market, where MathWorks has been the dominant player with its Matlab and Simulink. However, by combining a free strategy to encourage adoption as well as an open strategy (Chesbrough & Appleyard 2007) on the ecosystem side to advance the open innovation and formation of indirect network effects, a challenger called Scilab has been able to get a foothold in the previously somewhat monopolistic market. The free strategy was seen needed to minimize the switching cost that would already be inflicted to the users of Matlab due to their subscription payments. Even though Matlab had a strong user-base, it did not, however, possess a robust multi-sided model, which would induce indirect network effects, as it did development mainly in-house. By fostering an open ecosystem, Scilab was able to attract users and developers, between which indirect network effects could arise. Additionally, open innovation, which provides the external ecosystem with the ability to develop the functionalities further, also helps Scilab compared to Matlab, which has to keep investing in in-house development (Blondel & Edouard 2015).

The strength of indirect network effects was also explored in the Nordic mobile payment market by Staykova and Damsgaard (2015), who noticed that Swipp was able to gain almost as many merchants on board its platform compared to the first-mover Mobile Pay, even though Mobile pay had almost three times as many users. This further promotes the idea that indirect network effects can be created and participants on one side of the platform can be attracted, even though the dominant platform had significantly larger user-base on another side of the platform. Obviously, in the mobile payment industry, the switching and multi-homing costs for both merchants and users are low, and thus for merchants, there is no reason to not support both platforms, even though users would most often only use the more popular one. Suarez and Kirtley (2012) also propose a strategy for market entrants to overcome the first-mover that could have well been used by Swipp to increase the number of

merchants further. They could have made the business model more attractive for merchants so that they would start preferring Swipp over Mobile Pay, which could eventually also increase the number of Swipp consumer users.

The importance of the timing of the market entry as well as other evolutionary steps, can also play a significant role in the success of the platform. If a first-mover has made its market entry, the early followers should likely follow soon after in order to avoid the potential entry barriers caused by a sizable installed base that the first-mover could accumulate (Staykova & Damsgaard 2015). Thus, the timing of the market entry should also be a consideration, especially when the market is moving fast, and the first entrants are gaining momentum. In these situations, especially larger players can bundle the functionality of the first-movers platform into their other platform and make the disruptor obsolete. This strategy is called platform envelopment (Eisenmann et al. 2011), and for example, Microsoft successfully leveraged it to drive out Netscape from the browser market by providing Internet Explorer for free with Windows (Suarez & Kirtley 2012). The creation of a complementing platform in this way can also be considered a market entry for a platform-based business. This type of constellation of interlinked platforms is called engagement ecosystems by Breidbach et al. (2014). Engagement ecosystems provide a concept to inspect these higher-level constructs of groups of mutually dependent platforms, which can also evolve over time. The engagement ecosystem is not to be confused with the business ecosystem around a platform, that consists of different platform participants.

The platform and its ecosystem likely evolve after the market entry while it tries to tap into new opportunities such as new markets and combat emerging threats such as competition. Considerations and strategies for market entry have already been discussed from both incumbents and entrant's perspective. Rong et al. (2013), on the other hand, take a longer-term view on the platform's and its ecosystem's evolution over various phases. First, they propose that at birth and expansion of a business ecosystem, the platform is likely to employ an open strategy. This claim would also comply with Blondel and Edouard (2015) regarding Scilab. However, Rong et al. (2013) mention that the open strategy of involving partners in the development of technology and providing them with tools is often associated with immature industries. It could be argued that this was not the case in numerical computing, where

MathWorks was a well-established and monopolistic player. On the other hand, the industry had not seen serious competition, taken the dominant position of MathWorks and also a claim of market rebirth which could be made with Scilab's entry. Further down on their evolution, after the birth and expansion, According to Rong et al. (2013) platforms often adopt a dominating strategy. In this more mature state, the keystone company makes the platform closed to the ecosystem, but still allows limited access to the complementary parts of the technology in order to enable partner participation to a certain extent. This allows the keystone to dominate the market, especially in more mature markets. If there, however, is more uncertainty and the market is immature, firms may still employ the open strategy. Finally, when the business ecosystem enters into the renewal phase, an opportunistic strategy is often employed, and the keystone company tries to find the right substitute for the existing platform in order to stay relevant. A new, renewed ecosystem is also needed around the new platform (Rong et al. 2013). Thus, the ecosystem and the platform strategy can evolve over time.

A platform can also have a different focus in its ecosystem at different stages. Muzellec et al. (2015) studied this phenomenon by concentrating on the evolution of the focus of internet platforms. Similarly to the Nordic mobile payment platforms Swipp and MobilePay (Staykova & Damsgaard 2015), the internet platforms seemed to concentrate their value propositions towards the end-customers or users in the early phases. Most of the effort was put into convincing these groups of the value of the services. The participation was in both cases also strengthened by offering the services for free to these end-customers and users. However, in the next stages, internet ventures focused on evolving the ecosystem towards business partners. The need for solidification of the business model as well as the generation of revenue were found to be the main drivers of this change. This requires realigning the value propositions also to be attractive to the business partners. According to Staykova and Damsgaard (2015), Swipp and MobilePay also added a business-side in the form of the merchants to their value proposition, allowing mobile payments in the merchants' stores. Finally, the internet ventures enhanced their value propositions to embrace both the end-customers and the business partners in a sustainable manner (Muzellec et al. 2015). The evolutionary path can also thus be considered through the value proposition of the platform as well as through adding sides to the platform ecosystem as both Staykova and Damsgaard (2015) and Muzellec et al. (2015) in essence did.

Even after initially successful evolution, the platform ecosystem can face decline. West & Wood (2013) discuss the three fundamental ecosystem challenges that according to their analysis, were in a critical role in the fall of initially hugely successful Symbian mobile platform. First, evolving a complex ecosystem around a platform in a sustainable manner is not a trivial task that would likely succeed without experienced managers. In the case of Symbian, both its and Nokia's sides lacked the experience and knowledge on how to build and manage an ecosystem, which on the other hand, for example, Apple possessed. Second, the asymmetric dependencies within the ecosystem led into situations, in which not all parties were able to run their businesses successfully. For example, with Symbian, Nokia focused on high-end phones with high margins, which sold in relatively low volumes. This and Sony's and Motorola's low Symbian sales led into the rather limited market for the application developers, who could not get enough sales or profits for their development efforts, eventually forcing them to concentrate on other platforms (West & Wood 2013). Understanding the dependencies within the ecosystem and ensuring success for all the relevant parties is thus a necessity for the survival and prosperity of the platform. Finally, if the leadership within the ecosystem is too fragmented, the alignment of goals and direction may be impossible. This can lead to a situation where different parties within the ecosystem are unintentionally undermining each other with their actions and the platform will eventually face decline.

2.5 Platform adoption

Platform's ability to induce adoption by various potential platform participants, such as complementing business partners and end-customers, is a central consideration in the platform's evolution and largely defines platforms success. Adoption of the platform allows for the powerful network effects to form (Eisenmann et al. 2011; Parker & Alstyne 2005; Reuver et al. 2017; Rochet & Tirole 2003), which translates into the diffusion of the platform to even larger pool of participants (Steiner et al. 2016). The factors affecting platform adoption and the motivation of various platform participants to participate in a platform are many, and they have been the focus of the study in many articles (Fu et al. 2018). Five different aspects are discussed in this section.

First, the financial aspects related to the decision on joining or participating in a platform are considered to be central, especially for complementary business partners. Song et al. (2018) found out in their study of mobile application developers that their platform adoption decision is affected by their future potential for profits. The developers were primarily concerned over the sales of their products and thus were found to be utilitarian rather than hedonic in the selection of the platform. Koch and Kerschbaum (2014) also concentrate on the mobile application market, but their approach separates those developers who are driven by intrinsic and extrinsic motivation in their platform adoption decisions. For those who are motivated by the extrinsic factors, the potential for financial gain and the market size that a platform provides access to would be the key decision factors, whereas the developers driven by intrinsic motivation would find other factors more central (Koch & Kerschbaum 2014). In their study of smart home platforms, Kuebel et al. (2015) point out that many complementors primarily consider the platform as a sales channel, and thus they present the distribution power that the platform could provide for their products or services an essential factor. This would be especially true for smaller players who cannot access markets without such platforms as partners (Ceccagnoli et al. 2012; Kuebel et al. 2015).

Second, social and community aspects can be important for various platform participants. The platforms ability and willingness to invest in the partner ecosystem can have a significant effect on the platform adoption decision (Kuebel et al. 2015). Song et al. (2018) highlight the importance of a developer community in attracting developers to a platform. They claim that such a community allows the communication between developers but also between the developers and the platform owner. This can be highly valuable for the developers as they can share ideas and help each other, and additionally, they can also provide feedback to the platform owner (Song et al. 2018). Also, a growing number of business partners on a platform could further stimulate adoption as that would signal the viability of the platform to potential business partners (Kuebel et al. 2015). The open-source software development communities provide a great example of virtual communities that are essential in the further development of the software (Van Antwerp & Madey 2010; Hinds & Lee 2008). Additionally, Steiner et al. (2016) emphasize the importance of a community to the social gamers in their adoption decisions in the gaming console market. The same importance of the existing community, or the

expectation that there will be a vivid one, is the driver for adoption in social networking platforms, such as Facebook or LinkedIn.

Third, the amount, variety and source of the content in a platform has also been identified to affect the adoption of a platform. In case of biased platforms (Yoo et al. 2007), in which the platform owner also provides 1st party content (Hagiu & Spulber 2013) to the platform, the competitive landscape may seem tougher for business partners considering to participate in the platform, especially if the first-party content is substitute to the business partners offering. Offering first-party content extensively might however be necessary for some platforms in their early stages to induce adoption for example among buyers when business partners cannot yet be attracted to provide that particular content (Hagiu & Spulber 2013). Cenamor et al. (2013) note that first-party participation and substantial control of the platform might induce fear among potential business partners of monopolistic behavior, leading to decreasing adoption. However, the situation should be precisely contrary if first-party content is complementary to that of the business partners, and that should merely increase the adoption (Cenamor et al. 2013). The same should apply for third-party complementary content that could in the same way as with complementary first-party content enrich the business opportunities of business partners (Kuebel et al. 2015). Additionally, the buyers of products or services appreciate the variety and complementing nature of the offering that a platform could provide and Kuebel et al. (2015) considered this to be the most critical factor affecting platform adoption.

Fourth, the enablement and technological aspects, especially with digital platforms, are central factors in platform adoption among various participants. Koch and Kerschbaum (2014) claim that the toolkit, including integrated sets of product design, design-testing and prototyping tools, offered by the smartphone platform ecosystem is an essential factor for developers in selecting the platform. Similarly, Song et al. (2018) argue that mobile application developers will adopt the platforms, which provides high technical compatibility and can help them improve the quality and effectiveness of their work. Thus, to attract business partners, such as developers, in technology-intensive platforms, the platform owner must ensure that the platform is technologically advanced and that it provides sufficient instructions to the participants to efficiently participate to the platform (Song et al. 2018). The ability

to multi-home might also be a technologically important factor in platform adoption for business partners. Hyrynsalmi et al. (2016) describe that the most downloaded applications in the mobile application market can be found from more than one application marketplace, meaning that the developers are multi-homing their applications. However, the less successful developers are mainly single-homing their applications. Furthermore, they found that the multi-homed applications were often rather simplistic in nature, meaning that it did not take much effort to develop multiple versions of the application (Hyrynsalmi et al. 2016). Thus, arguably, allowing effortless multi-homing for platform participants could increase platform's adoption.

Finally, personal benefits and enjoyment have been identified as platform adoption influencers. Koch and Kerschbaum (2014) claim that developers, at least intrinsically motivated ones, prefer platforms that provide them with most opportunities for learning, intellectual stimulation and having fun developing content to the platform. However, Song et al. (2018) provide an opposing view that mobile application developers seem unconcerned with perceived enjoyment and that they would not be that intrinsically motivated. The potential difference in this could derive from the data collection methods. Koch and Kerschbaum (2014) employed an internet questionnaire that resulted in answers from a significantly more heterogeneous group of respondents. Ages ranged from 15 to 34, the respondents were geographically dispersed, and they had varying educational backgrounds. Whereas Song et al. (2018) interviewed academically educated South Korean professional application developers with ages ranging from 31 to 42. Thus, Koch and Kerschbaum's (2014) sample may include more developers to whom application development was not a full-time job, rather a hobby and thus, they may be more inclined to be intrinsically motivated. Steiner et al. (2016) also claim that to gaming console end-users the source of satisfaction can vary significantly between the social and hardcore gamers. That creates different adoption patterns to different platforms that are aimed at different customer segments.

Table 1, aspects affecting the platform adoption based on the literature review

Aspect	Description
Financial	High potential for future profits and a large accessible market through the platform induce adoption
Social and community	For example, developer communities might be valued highly by developers, when they consider their platform choices
Amount, variety and source of the complementary content	Affects the competition for the potential business partners; first-party participation may induce fear of monopolistic behavior and reduce adoption among partners if content is substituting to each other, if complementary has the opposite effect
Enablement and technology	The ease of becoming a productive contributor to the platform and the available resources to affect that, such as training, can increase adoption
Personal benefit and enjoyment	The more there are opportunities for personal learning, intellectual stimulation and fun, the more likely the partners will adopt the platform, if they are intrinsically motivated

Especially the first three presented factors – financial, social and content - are also intensively related to the network effects. The financial aspect of adoption is related to the platform's ability to create direct or indirect network effects depending on the platform's business model. For example, business partners with extrinsic motivation adopt those platforms, which have the largest customer network size for them (Koch & Kerschbaum 2014), translating to the most considerable indirect network effects from their perspective. In terms of those potential participants who value social aspects and community building in their platform selection, the higher the number of their peers, the higher the adoption of the platform. Lastly, the higher the variety and complementarity of the content on the platform, the more it has potential to create both direct and indirect network effects that further attract more participants and increase the adoption. However, it is not merely the present network effects that affect the adoption decisions, but also the expectations of how the network effects will look like in the future (Steiner et al. 2016).

3 Methodology

This chapter describes the research methodology applied in the thesis. The research setting is presented first and followed by a description of the applied research methodology. Finally, data collection and analysis methods are discussed.

3.1 Research setting

This study explores the opportunities and key requirements for expanding a platform ecosystem, that originates in the telecommunications industry. The thesis is conducted from the platform owner's perspective, which is a global technology company that concentrates on the telecommunications industry. The company is exploring new potential avenues to exploit the investment in the technology platform, and thus, this thesis addresses very central questions regarding the platform's evolution.

The prominence of ecosystems, platform economy and digital platforms as research topics has increased over the last decade (Reuver et al. 2017). At least partly the academic interest can be contributed to the unprecedented success of the world's largest companies, based on market capitalization, of whom many are employing platform business models. In February 2019, five out of the six largest U.S. companies were mainly operating on the platform business model (Picardo 2019). This underlines the fact that in today's world, a digital platform with significant gravity towards external parties can be financially extremely successful. Thus, many incumbents, that have traditionally been emphasizing vertical integration, or have acted as manufacturers or re-sellers, are now aiming to apply the fundamental business principles of open platforms in their core businesses (Moser et al. 2017). This means that they would allow partners to participate to the development and commercialization of their platform and its complements (Boudreau 2010). This study takes a forward-looking view on such a situation in the telecommunications industry, which has not previously been covered to my knowledge in the academic literature.

3.2 Qualitative research approach

Taken that the focus of the thesis is to generate an understanding of a specific situation in a real-world context, the qualitative research method is employed (Golafshani 2003; Ritchie & Lewis 2013). Qualitative research is typically used to describe the form or nature of something that exists, study the reasons for, or associations between something that exists, assess the effectiveness of something that exists and to aid the development of theories, strategies or actions (Ritchie & Lewis 2013). Corbin and Strauss (2015) note that the primary reason to choose the qualitative research method is to understand the studied phenomenon from the participants perspective, potentially leading to discoveries that contribute to the development of empirical knowledge. However, they also point out that in qualitative research, the researcher is as much part of the research process as the participants of the study and the data provided by them. Thus, the researcher's role is not merely to conclude from an existing dataset, but to also take part in the interaction with the research participants. In this research, that role materializes through the interviews.

Since the theory and research are scarce on the topic of expanding a platform ecosystem in the telecommunications industry to involve partners, an inductive research approach is employed in this thesis. Fu et al. (2018) also note in their extensive literature review, that covers 187 articles on platform literature, that the study of platform ecosystems is still at an exploratory stage. This general note on the status of the literature additionally strengthens the justification of employing an inductive research approach in this study. As opposed to conductive research, in which existing theories are tested, the inductive approach concentrates on building new theory based on empirical observations (Saunders et al. 2009). Thus, no specific theory is considered in the data collection phase, and instead, the theory is induced from the observations. The observations are many and from a diverse group of people, ensuring that a holistic view is gained. The observations were employed through design science research methodology in designing artifacts that could solve the research problem.

3.3 Design science research methodology

Design science is a research methodology widely used in the engineering disciplines due to the cultural emphasis on the importance of incrementally effective applicable solutions to problems (Peffers et al.

2007). It is a scientifically valid problem-solving methodology, which aims at creating innovations that stem from the ideas, technical capabilities, practicalities and products related to the studied phenomenon (Hevner et al. 2004). The essential difference between natural sciences and design science is that while natural sciences aim at understanding the reality, design science aims to create artifacts that effectively serve human purposes (Hevner et al. 2004; Peffers et al. 2007). Thus, the core of design science lays at the creation of artifact(s) that solve the focal problem by satisfying the objectives of the solution. The creation of these artifacts relies partly on existing theories but also draws from the experience, creativity, intuition and problem-solving capabilities of the researcher (Hevner et al. 2004). Hevner et al. (2004) also present the four main categories for the artifacts in information systems research: constructs (vocabulary and symbols), models (abstractions and representations), methods (algorithms and practices) and instantiations (implemented and prototype systems). Peffers et al. (2007) on their behalf, generalize the artifact in design science and claim that it can be any designed object with an embedded solution to solve the research problem. The essence of the design science is thus to thoroughly understand the real-world problem and come up with a concrete solution to it in the form of an artifact.

As this research concentrates on expanding the platform ecosystem of a technology platform originating in the telecommunications industry by involving partners to it, the solution to the problem is necessarily a platform ecosystem model or collection of such models. These models are necessarily abstractions of the potential platform ecosystems towards which the platform ecosystem could evolve. This requires designing feasible ecosystem models and studying the mechanisms and requirements to actually be able to reach them so that there is sufficient knowledge on how to materialize the models in the real-world context. The research is additionally highly forward-looking in nature as the potential outcomes of the evolution are not present today. Furthermore, the research is conducted for a real-world company, which calls for a highly practical research approach that could provide useful insights and solutions on strategic questions. Thus, taken that there is a significant emphasis on designing concrete, forward-looking, real-world artifacts, the design science research methodology is well suited for this research (Hevner et al. 2004; Holmström et al. 2009; Peffers et al. 2007).

In order to have scientific legitimacy, the research process should be based on an academically approved design science framework. This research applied the widely cited design science research methodology (DSRM) process presented by Peffers et al. (2007). The key phases of that DSRM process are 1) identifying the problem and motivating, 2) defining the objectives of the solution, 3) designing & developing the artifact, 4) Demonstrating the artifact, 5) evaluating the artifact and 6) communicating the results of the study to the necessary audience (Peffers et al. 2007). Additionally, Peffers et al. (2007) emphasize the importance of the entry point for the research and obviously, this research was initiated by the focal company, which provides the context for the study and the to be designed artifacts. Taken the limited duration of the thesis work as well as the resources that would have been required to carry out concrete demonstrations of the more open platform ecosystem models, a slightly adjusted process was implemented.

Additionally, due to these limitations and the lack of actual implementation of the models during the research, CIMO logic was employed to develop design proposals through the research. CIMO logic can commonly be found in the design science literature (Groop et al. 2017), and it describes the context, intervention, mechanisms and outcomes of a design proposal (Denyer et al. 2008). The context is the surroundings and the situation with the focus of the study, whereas the intervention aims to affect the perceived issues in the context. The mechanisms are the means through which the interventions can produce the expected outcomes. In this research, context can be primarily associated with the problem definition phase, while the different interventions are produced in the objective definition and design phase. The 1st wave of interviews contributed to both of these. The outcomes and the mechanisms of reaching the models through the interventions are studied in the virtual demonstration and evaluation through the 2nd wave of interviews. Furthermore, CIMO is merely an abbreviation, and it does not define the sequential order in which the described activities take place (Groop et al. 2017). In this research, the order could be considered C-I-O-M, as the outcomes were discussed before the mechanisms in the 2nd wave of the interviews.

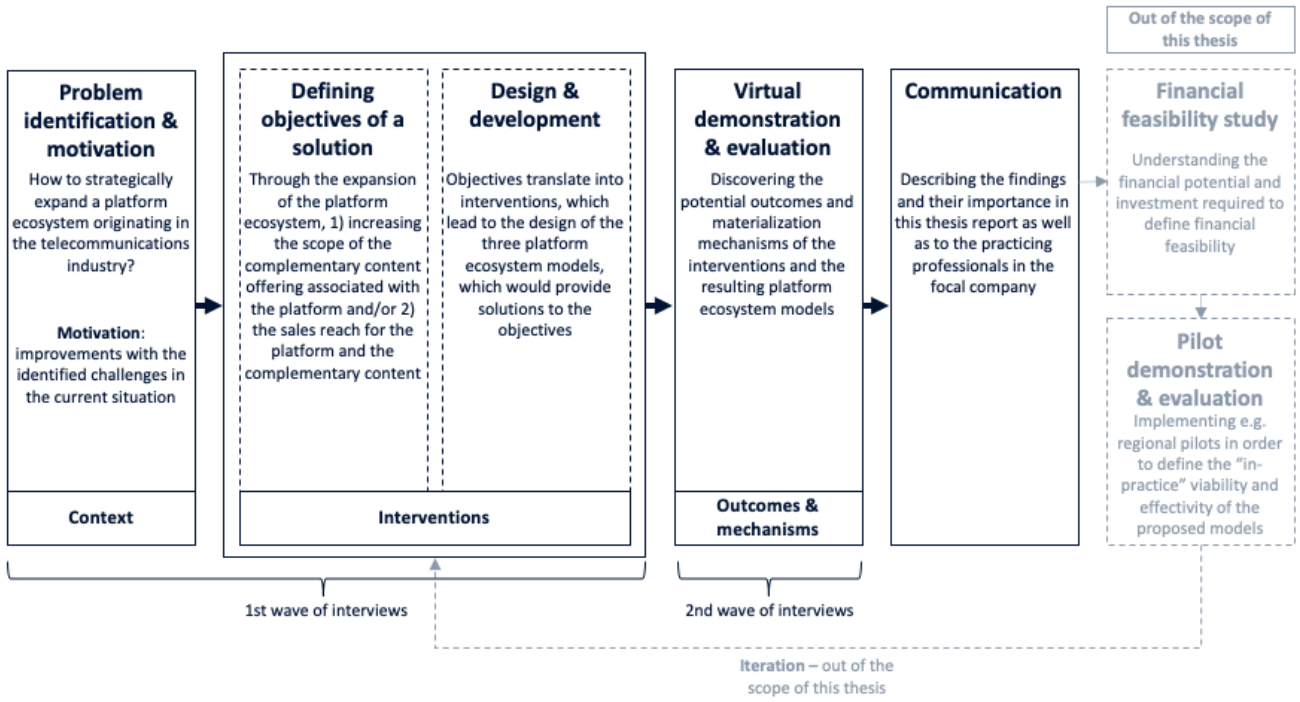

Figure 2, DS research process with CIMO logic employed in the thesis – adapted from Peffers et al. 2007 and Denyer et al. 2008

Problem identification and motivation. The initial consideration by the focal company was that how could the focal platform, which was mainly harnessed internally, be more extensively exploited by a broader set of users. In the first discussions with the company, the direction of the research was locked into considering the expansion of the platform ecosystem by involving partners to it. This was an exciting research direction for all parties since the considerations of increased involvement of external parties had not been extensively studied within the company yet, due to the rather recent introduction of the platform. The more specific research problem thus became: *"How to strategically expand a platform ecosystem originating in the telecommunications industry?*" Thus, this phase provided the context for the research along with the issues in the current situation. Most of the problem and context definition was based on the 1st wave of interviews as well as on some informal discussions that were had with various representatives of the focal company in the early days of the thesis project.

Defining the objectives of solutions and designing and developing the models. The objectives of the solution should describe how the solution would intervene and improve the current state. The high-

level objective was obviously that the solution would enlarge the business opportunities of the platform by involving partners to the platform ecosystem. That is, however, too vague of an objective, and there was a need to sharpen the focus. The idea was to design interventions that would result in a few models, which could then be assessed further down in the research. To offer feasible solutions, the ecosystem models should be designed so that they would adhere to the objectives of the solution. Thus, in this research defining more specific objectives for the solution, translating them into interventions, and designing and developing the models based on the interventions were linked to each other. To be able to conduct this effectively, it was necessary to build atop of the understanding of the context gained from discussions with focal company representatives and further extend the knowledge by leveraging the academic literature on the relevant topics.

Thus, the literature review was conducted with a focus on the platform economy and ecosystems but also exploring the associated technologies from the theoretical point of view. Simultaneously, a questionnaire and discussion materials were prepared for 1st wave of interviews to gain an in-depth understanding of the potential future ecosystem paths from the employees of the focal company as well as solidifying the understanding of the current situation. The 1st wave of interviews featured four formal interviews. In addition, many informal discussions also provided insight into this phase, contributing to both the context as well as the to be interventions of the study. The objectives of the solution were formed based on the interviews and informal discussions, which translated into interventions that also provided a rather straightforward avenue to design and develop the platform ecosystem models. The defined objectives would represent two dimensions, on which the interventions to the current state could be considered. Thus, the result of the design and development was two dimensions with an apparent intervention in each. More specifically, this resulted in a 2x2 matrix with two dimensions and two alternatives in each resulting in four platform ecosystem models. Out of the four models, one represented the current situation, in which neither of the interventions was carried out, and thus, the platform ecosystem was mainly populated by the focal company and end-customers. The other three had either one or both of the interventions implemented.

Virtual demonstration and evaluation of the solution. The decision to immediately design multiple potential models in the previous phase was primarily related to the demonstration and evaluation phase of the research. It was not possible to demonstrate and evaluate the models in a real-world setting due to the time and resource constraints of a master's thesis. This meant that neither the outcomes nor the mechanisms to reach them, could be defined through a practical implementation of the models. Instead, this phase was conducted by running interviews to test the interventions and the models resulting from them to gain an understanding of the potential benefits and mechanisms to actually materialize the models. Except for one exception, each interviewee could only be interviewed once. This would have made it impossible to evaluate an iterated model with the same interviewee again. The fact that the interviewees in the 2nd wave of interviews eventually had quite different profiles only strengthened the benefit of providing the same multiple models in these interviews to be evaluated for all the different interviewees. An alternative approach of only having one designed model and constantly iterating it between the interviews of different people would have likely resulted in an inconsistent process and outcome.

The demonstration and evaluation of the proposed solutions were carried out through ten internal and six external interviews. In these interviews, the idea was to demonstrate and evaluate the applicability of the models through gaining an understanding of the potential benefits and the mechanisms of actually being able to materialize them. There is a significant difference between an abstract design proposition and a design proposition with an understanding of its potential outcomes and the mechanisms to materialize the outcomes. The abstract model alone would not provide the necessary means to carry out an intervention and reach the objectives that were set in the previous phase, but there needs to be a more extensive understanding of the mechanisms to do so. With this gained understanding, all of the three new models would achieve the objective of the solution through at least one of the two interventions.

Communication of the solutions*.* Finally, the platform ecosystem models resulting from the interventions represent the designed artifacts, which are backed up by the context, a more thorough understanding of the outcomes and mechanisms of carrying out the interventions. These are presented

in this thesis paper and are discussed thoroughly with stakeholders from both the focal company and the university. It is worthy to note, that in this research the outcome is not necessarily a single model to solve the problem, but rather a collection of models, their potential beneficial outcomes and the requirements to carry out the interventions to reach the outcomes. Defining the strategic direction and validating the decision on which of the models to eventually aim for would, however, require a rigorous feasibility study.

Financial feasibility study – out of the scope of this thesis. A more detailed feasibility study would have to be conducted to justify the real-world strategic decision on whether it would be financially feasible to consider moving away from the current model towards any of the proposed designs. In the core of that study would be defining the revenue potential and the required investment to ramp-up and maintain a new model. These have not been directly in the scope of this study and conducting a feasibility study would be a separate project. It could, however, leverage some insights also from the findings of this research, especially regarding the beneficial outcomes and the mechanisms of reaching them.

Demonstration and evaluation of the solutions through pilots – out of the scope of this thesis. Carrying out concrete, in-practice pilots of the proposed models also falls out of the scope of this thesis due to apparent time and resource constraints. However, in a larger scale consulting or research project, for example, regional pilots could be employed to validate the findings of the interview-based demonstrations that were applied in this research. Limiting the pilots to, for example, a specific region could also provide room for smart iteration as the feasibility would have been tested without an enormous investment in transforming the employed model globally throughout the entire platform. Thus, for example, the objectives could be changed if it was perceived that they do not provide a sufficient frame for the interventions and the models, or if the necessary changes were more detailed, the proposed models could be enhanced further without tampering the high-level interventions themselves. Setting up clear metrics for evaluating the pilots would then provide a foundation for deciding whether there would be a need for iterations.

3.4 Data collection

The primary data source in this research was the interviews with focal company employees as well as external industry experts and potential ecosystem partner representatives. In total there were 20 formal interviews in two waves featuring 19 separate interview sessions. The first wave concentrated on gaining data to understand the context and to define the objectives of the desirable solutions as well as designing them. The first wave featured four internal interviews, and they were conducted in February 2019. The second wave concentrated on the potential beneficial outcomes and mechanisms of carrying out the interventions that would lead to the models. The second wave interviews featured ten internal interviews and six external interviews, and all of the interviews were conducted between March and May 2019. Four of the external interviews were conducted with potential partners to be featured in the suggested platform ecosystem models, and two were conducted with external industry experts. 18 out of 20 interviewees were already familiar with the focal platform before the interview. Two representatives of a potential future partner company to the ecosystem had not, however, earlier been acquainted with the platform and thus, an extensive introduction was carried out to ensure a meaningful interview. Table 2 presents the complete interview roster without disclosing the names or exact organizational locations to protect the anonymity of the interviewees. The interviewees had various specialties, and some were technically-oriented, whereas others were more involved in the business and strategy aspects in their work. This provided a holistic and multi-disciplinary view that is needed with topics, such as this, in which the technology itself is quite advanced and central to the business.

The duration of the interviews varied from 30 minutes to 60 minutes, and all except for two interviewees were interviewed individually. The exceptional case was with two potential ecosystem partner representatives from an adjacent industry being interviewed simultaneously. The interviews were semi-structured. Semi-structured interviews are well suited for this type of exploratory and design-centric research as they provide interviewees the opportunity to express their thoughts in their own words without the interview setting forcing the form (Saunders et al. 2009). Both the first and second wave of interviews featured their own questionnaires as well as discussion materials, such as the proposed ecosystem models visually depicted and described in the 2nd wave. Appendices A and B

present the interview guides for both waves of interviews. The questionnaires were not strictly followed in every interview, and if there was a lively discussion on a particular topic, that was not forcibly ended to be able to run through the entire questionnaire. However, in most of the interviews, there was enough time to go through all of the planned questions. Although it did not happen many times, the interviewees were also willing to refrain from answering if they considered that they did not have the necessary knowledge to provide a meaningful answer to a question. This also helped in the analysis of the data as this likely reduced the number of less informed answers from the interviewees.

Table 2, the full roster of formal interviews in the research

1st Wave of interviews – internals (4 in total)	
Area of responsibility	**Area of responsibility**
Business strategy	Strategy & portfolio management
Platform technical management	Commercial management (1st interview)
2nd Wave of interviews – internals (10 in total)	
Area of responsibility	**Area of responsibility**
Delivery management	Analytics technical management
Change management	Portfolio management
Offering management	Analytics sales
Analytics development	Cloud strategy
Business development	Commercial management (2nd interview)
2nd Wave of interviews – externals (6 in total)	
Affiliation	**Title**
Industry expert, analyst	Research VP
Industry expert, consultant	Partner
Potential ecosystem partner	Sales manager
Potential ecosystem partner	VP of sales
Potential ecosystem partner (adjacent industry)	Director of digital platforms
Potential ecosystem partner (adjacent industry)	Head of IoT

3.5 Data analysis

As this an inductive research, it is natural to have the data collection, interviews, in this case, aligned with the data analysis. Thus, the analysis of the data started after the first interview in both of the interview waves. Each interview was recorded, and the recording was transcribed from the audio format into digital notes usually immediately after the interview took place, but at the latest on the day after. The Gioia method was mainly employed in the analysis of the interview transcripts using the open coding practice, in which the codes were created and named (Gioia et al. 2013). First, the individual quotes represented the first-order constructs, which were then categorized under the second-order constructs and finally allocated under the overarching categories. As an illustration of this process in the investigation of the partner attraction factors, the individual quotes from the interviewees were the first order constructs. The second-order constructs were the identified attraction factors, such as the "easy involvement". These factors were further categorized under third-level dimensions, such as "enablement and technology".

The well-planned questionnaires and discussion materials in both waves of interviews seemingly also helped in the analysis of the data. The discussion materials explained the background and set the context for the interview enabling more focused discussion. This also translated into the answers, which primarily addressed the questions on point, and thus helped the categorization of the answers. Especially in the 2nd wave of interviews, the proposed interventions and the three new proposed models accompanied by a well-structured questionnaire made the analysis of the data reasonably straightforward. Thus, the effort put into preparing the discussion materials helped in both the data collection and analysis, and also resulted in compliments from the interviewees. The groundedness of the items is not highlighted in the analysis as it does not strictly translate into their relevance. Obviously, if something comes up in many different interviews, thus having high groundedness, it can be a crucial factor in, for example, attracting potential platform ecosystem partners. However, it can also mean that the item is more obvious, which does not directly translate into importance or relevance. A critical point in the big picture might only surface once in the interviews and comparing items to each other should not be based on the groundedness in this type of an exploratory study.

4 Findings

This chapter describes the findings of the thesis. First, the context and the issues with the current situation are discussed. Second, the platform ecosystem model proposals that are based on the interventions are presented with the potential partner types with each intervention. Third, the potential outcomes of the interventions are laid out, focusing on the benefits to the end-customers and the focal company. Finally, the mechanisms through which the proposed platform ecosystem models could be materialized are discussed.

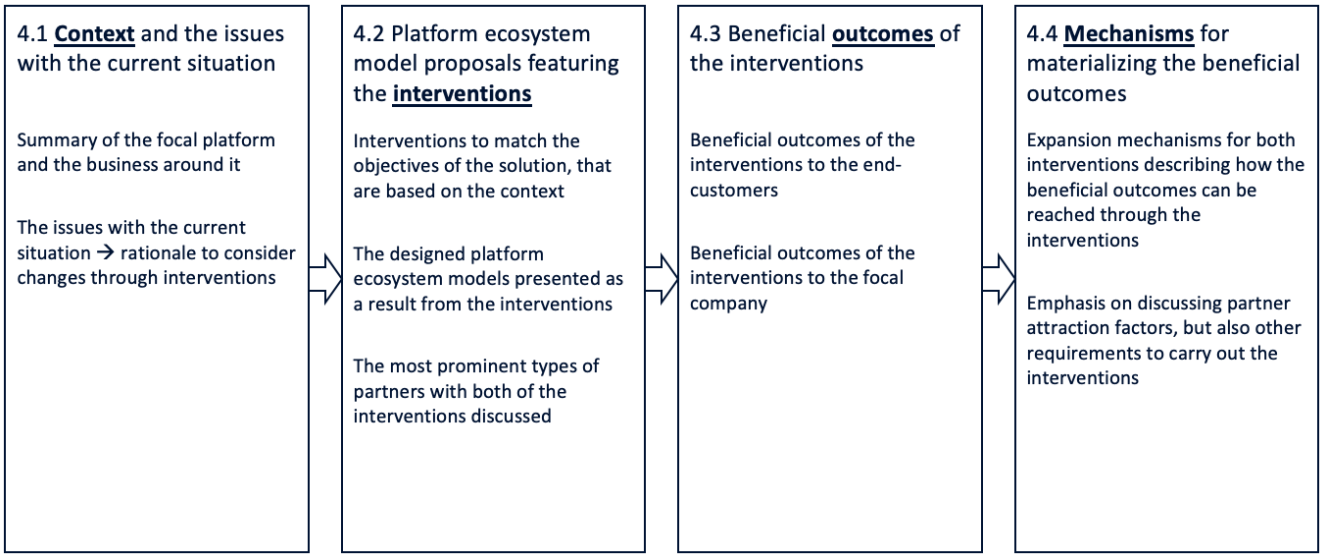

Figure 3, structure of the findings chapter

4.1 Context and the issues with the current situation

The focal platform integrates analytics, virtualization and automation technologies and tools to deploy various services to end-customers, which at this stage are mainly communications service providers (CSPs). In more concrete terms these services are implemented through complementary content, that is developed and ran atop of the platform. The complementary content can, for example, be an application that aim to improve CSP's network availability. The complementary content is developed so that it is compatible with the analytics, virtualization and automation technologies and tools in the platform and leverages them when utilized. The platform itself is developed and maintained within the focal company and this thesis does not consider directly involving partners in the development of the

platform itself. Currently the complementary content atop of the platform is also only developed in-house but bringing partners into the development of the complementary content is within the scope of this study. The focal platform, in its current state, is a technological construct. It is not a multi-sided platform in the business sense, even though such a business including an ecosystem could be built around it. In most cases currently, the end-customer is sold an outcome – for example, the improvement in the network availability. The focal platform and the complementary content serve as means of achieving that.

The platform is a result of significant investment from the focal company, and according to various analyst companies, it is the leading platform in the industry. The financial commitment to the platform was the driver for the company to consider how the business around the platform could be developed further to reduce the payback time and grow new businesses with it. The technological prowess and the recognition it has gained within the industry would hold promise to have the potential to utilize the platform more extensively than today. The chosen avenue for this thesis to assess these possibilities was to consider the expansion of the platform ecosystem by involving partners in it. The interventions covered in the following section are based on the current situation and aim to solve some of the issues identified in it. Those interventions are also the foundation for the designs of the platform ecosystem models that are presented. The following items that are synthesized from the interviews, adequately summarize the rationale to consider changes to the status quo:

1. None of the interviewees in the 1st wave considered that the full value creation potential of the focal platform could be unleashed without extensively involving partners.
2. In addition to reducing the payback time to the currently standing investment, the platform itself is seen to need further investment in the future to stay technologically relevant. Thus, increasing the utilization of the platform by expanding the ecosystem around it and enabling more revenue generation is one solution to finance that.
3. Even though the foundation of the focal company is in the telecommunications industry, the overall strategy of the company also aims at expanding to adjacent industries, such as transportation.

However, currently the focal company is considered to have limited sales reach to customers in those industries as well as limited ability to develop complementary content to suit their needs.

4. The focal company has limited amount of resources in the complementary content development and has chosen to concentrate only on a limited variety of content that has the highest revenue potential. This leaves out a long tail of content with smaller revenue potential but also with lesser resource requirements to develop. However, customers would find this content valuable and especially for many smaller development companies the revenue potential would be sufficient.
5. The traditional project by project sales that is primarily employed currently with the focal platform and its complementary content consumes a significant amount of resources.
6. There is currently high uncertainty about the future, not least due to the dawn of the 5G, which will have an effect on the business dynamics within the telecommunications industry but also in many other industries. Facing that future alone without a strong platform that can attract an ecosystem might expose the business currently conducted around the platform to significant vulnerabilities.

These items, as well as the general description of the platform, provide the context for the design of the interventions and the proposals for the platform ecosystem models resulting from them. The interventions on their turn provide grounds to study the potential beneficial outcomes and mechanisms of reaching them. The described context and the potential issues with the current situation motivate to explore avenues, through which a foundation for an improved business around the platform can be built.

4.2 Platform ecosystem model proposals featuring the interventions

The first wave of interviews was conducted to define the context and the more specific objectives for a solution that could solve the research problem. The interventions and the resulting platform ecosystem models that were formed, based on those more specific objectives, are presented in this section. The models provided a solid foundation for the considerations of expanding the ecosystem around the platform and acted as discussion material for the 2nd wave of interviews which focused mainly on the outcomes and the materialization mechanisms for the interventions and the resulting models. Additionally, the potential types of platform ecosystem partners are discussed in this section.

4.2.1 The interventions and platform ecosystem models

A number of potential partners and partner types emerged in the first wave of interviews when discussing the interviewees' vision for the platform ecosystem's evolution in the future. These are covered in the next subsection. By analyzing the emerging types of partners, it became rather apparent that a partner could either contribute to the development of the complementary content to the platform or sell the platform and the content to end-customers. Thus, the potential roles of the ecosystem partners around the platform unraveled, and the initial high-level objective of expanding the platform ecosystem could be further broken down into two objectives: first, increasing the scope of the complementary content offering associated with the platform and second, increasing the sales reach for the platform and the complementary content. Since the aim was to consider the expansion of the platform ecosystem by involving partners, these objectives translated into two interventions:

Intervention 1: opening the boundary towards development partners to allow them to contribute to the complementary content development atop of the platform.

Intervention 2: opening the boundary towards the consumption and involving sales partners as well as potentially a sales portal or marketplace for the sales of complementary content.

Both, one or neither of the interventions could be carried out in reality. This means that partners, in either the development or go-to-market dimension, could be introduced into the ecosystem, in addition to the focal company also preserving its activity in all of the three more open models. Figure 4 presents the current situation (M0) and the new platform ecosystem models (M1-M3) in relation to the interventions in both the development and go-to-market dimensions.

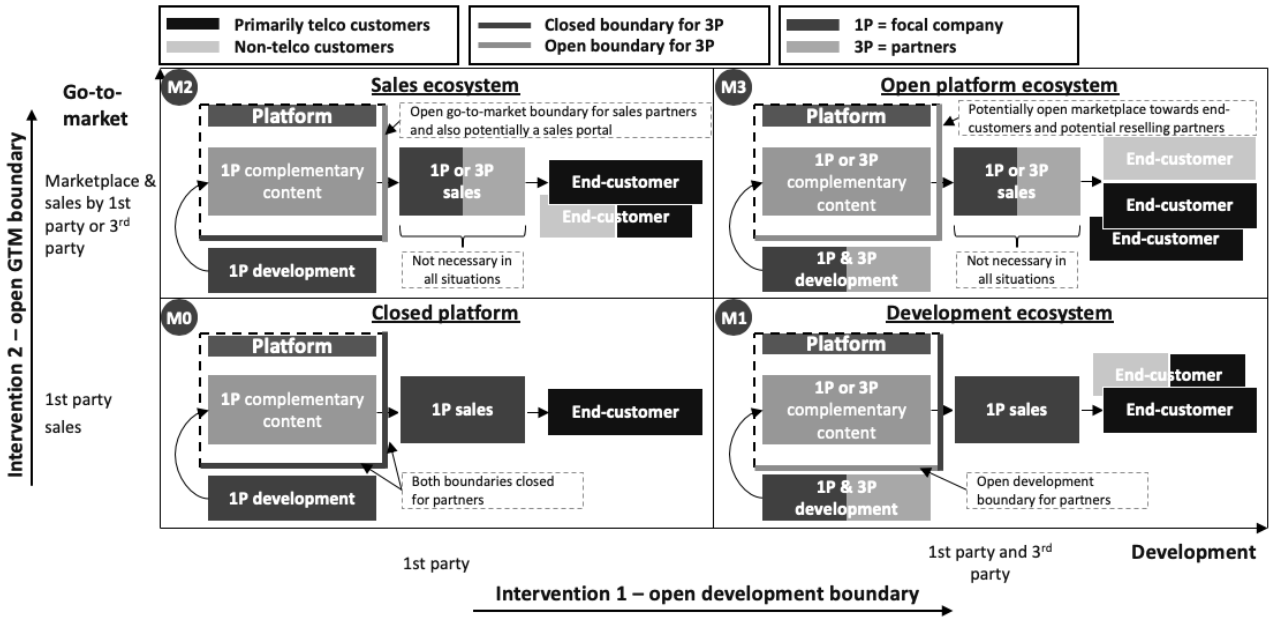

Figure 4, the interventions and the platform ecosystem models M0-M3

Model 0 – closed platform. This model represents the current situation with the platform. The platform is not open towards external parties except for the end-customers. The development of the complementary content to the platform is done within the focal company. All of the content also remains in the ownership of the focal company in this model. However, it is worthy to note a possible exception. A customer that has the platform deployed and is technically capable, can develop content for its own use. This does not, however, change the fundamentals of the model as it does not currently allow the customer to sell their content further. The content as well as the platform that needs to be deployed to the end-customer to deliver the service, are sold in a traditional project by project manner by the focal company's sales representatives. Finally, in terms of end-customers, this model has the potential to access and address customers in the telecommunications industry but has limited potential in adjacent industries. This is mainly due to the focal company's strong relationships with the CSPs as well as the deep-rooted domain expertise in the telecommunications industry. However, the focal company does not have an extensive background in the adjacent industries.

Model 1 – development ecosystem. The development dimension is open for potential partners in model 1, but the go-to-market dimension remains closed to partners, and thus similar to model 0. The

opening of the development dimension to partners means that there would be two different avenues for the complementary content to be developed to the platform. The first is precisely similar to the model 0, in which the focal company develops the content and preserves the ownership. However, the second avenue is the one in which a partner develops the content and has ownership over it. In this model, the focal company's sales representatives can sell its own content and the content created by partners. Thus, the development partners in this model would not themselves sell any content directly to end-customers. This results in the developer ecosystem around the platform for which the focal company would act as a go-to-market channel. The potentially increasing scope of the offering also has a chance of improving the ability to address end-customer needs also in other industries than the telecommunications.

Model 2 – sales ecosystem. The go-to-market dimension is open for potential partners in model 2, while the development dimension stays closed to partners, and the content is developed only by the focal company. There are, however, two new go-to-market channels in addition to the traditional project by project sales done by the focal company's sales representatives. First, allowing sales partners to sell the platform as well as the available complementary content to the end-customers. Second, adding a sales portal the for complementary content atop of the platform. The sales portal would show the available complementary content from the focal company and would be accessible for the sales partners and end-customers with the platform. Some of the complementary content could be self-serviceable, meaning that it could be utilized directly from the sales portal with the platform by a click of a button. Also, some of the technically more complex content could be visible in the sales portal. However, the more complex content would require a technically capable partner or the focal company to utilize the content for the end-customer as it would require some case by case modifications to the content's code. For this type of content, the sales portal would be more of a marketing channel as it would not allow self-service. In terms of end-customers, the reselling partners can also open doors to industries outside the telecommunications depending on their focus, which means that there could be potential expand in the sales reach.

Model 3 – open platform ecosystem. Both the development and go-to-market dimensions are open towards partners in model 3. This means that the complementary content available for the platform can be developed either by the focal company or by a development partner. In the go-to-market dimension, the sales of the platform and the complementary content can be conducted by the focal company or by a reselling partner. Additionally, there could also be a marketplace for the complementary content atop of the platform. The marketplace would have otherwise the same characteristics as described above for the sales portal in model 2, but it would have complementary content available also from the development partners and not only from the focal company. With sales partners, the reach to end-customers outside of the telecommunications industry could be improved while in parallel, the development partners could provide content that also addresses the needs of the end-customers better in the adjacent industries. Theoretically speaking, model 3 would also hold the most potential for indirect network effects. The more there is end-customers to the complementary content with the help of sales partners, the higher the value for development partners. Also, vice versa, the more there is development partners, the higher the value for the sales partners and end-customers.

Table 3, a summary of the key features of the designed platform ecosystem models

	Development of the complementary content	**Go-to-market for the platform and the complementary content**	**End-customers**
Model 0 (M0)	Focal company	Focal company	Primarily CSPs
Model 1 (M1)	Focal company and development partners	Focal company	CSPs and potentially content for adjacent industries
Model 2 (M2)	Focal company	Focal company and sales partners Digital sales portal for the complementary content	CSPs and potentially improved sales reach to adjacent industries
Model 3 (M3)	Focal company and partners	Focal company and partners Digital marketplace for complementary content	CSPs and the most potential to address adjacent industries

4.2.2 Potential types of platform ecosystem partners

Several potential partner types were identified in the interviews, and they could be categorized into the development and go-to-market partners, based on their primary association with either of the interventions. Some of the potential partners, such as technically capable communications service providers or consultancies, could, however, be present in both the development and go-to-market dimensions if model 3 was implemented.

The most prominent types of development partners to the focal platform ecosystem. The role of a development partner in the focal platform ecosystem would be to contribute to the complementary content offering atop of the platform. This content can, for example, be an application that leverages

the platform's analytics, virtualization and automation technologies and tools in improving the availability of a CSP's network. The partners in the development dimension that were considered the most prominent by the interviewees could be categorized into industry specific development companies, non-industry specific development companies and data provision companies. The industry specific development companies and the non-industry specific development companies would be directly developing the content atop of the platform, whereas the data provision companies would bring additional data sources to enhance the development of the content.

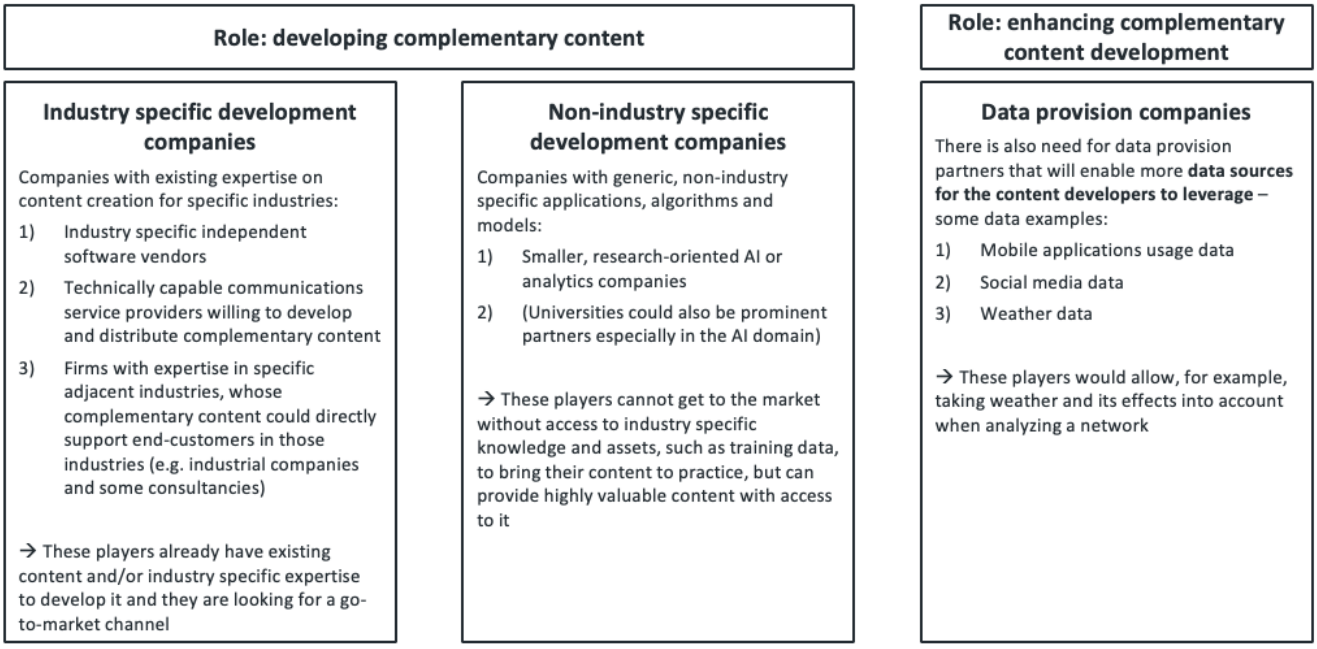

Figure 5, the most prominent types of development partners to the focal platform ecosystem

First, the industry specific development companies are focused on specific industries and possess expertise and assets to develop content to serve customers in those industries. These partners would be looking for an additional go-to-market channel, that the focal platform could provide them with. In the context of the focal platform, the primary industry is the telecommunications, but also adjacent industries are taken into consideration. Independent software vendors (ISVs), technically capable communication service providers (CSPs) and industrial companies, as well as consultancies, were the identified partners in this category. There is a large pool of ISVs out there with a specific industry or industries to which they focus on as the interviewed analyst industry expert noted: *"There is an entire*

universe of ISVs focusing on a specific industry, such as finance, and they have the domain expertise but also the technical capabilities and understanding of, for example, analytics to create content for the industry." The technically capable CSPs could provide interesting complementary content to the platform since some of them have strong in-house capabilities in terms of analytics, virtualization and automation. Currently, the CSPs are the primary end-customers of the services that are enabled by the platform and the complementary content. This means that by leveraging their own understanding of their needs, the CSPs could develop impactful content atop of the platform, that could also be sold to others. Additionally, industrial players, such as OEMs in the transportation industry, could also provide content in their respective fields of expertise. They would understand the technical details and business dynamics of their industries and could, for example, create content suitable for predictive maintenance of cargo handling equipment. This content could be developed and utilized on the focal platform. For example, the potential ecosystem partner company from an adjacent industry, whose digital platform director and head of IoT were interviewed, would also have the software capabilities to develop this type of content. Also, some consultancies have the technical capabilities and the industry knowledge to create such content.

Second, the non-industry specific development companies do not necessarily specialize in any specific industry. These could include software, analytics and AI companies with services or models that cannot unleash their full potential without, for example, industry specific training data sets. Many smaller, research-oriented start-up companies, who have not yet had a chance to work on real-world cases in a specific industry would fall in this category. The value of these companies' solutions may be significant when they can access the necessary industry specific assets, as the analyst industry expert said: "*[A start-up company name] is an interesting example of a company that offers quite a generic machine learning based procurement software that could well be applied to almost any industry. The software can effectively reduce procurement spending by multiple percentages. More than 80% of the effort goes into building the generic ML model and thus with a rather limited effort of providing curated training data sets, their software could also be applied to, for example, the telecommunications industry to serve the needs of CSPs.*" Even though probably not the first priority, universities could also be considered potential partners, especially in the areas of high-end AI and analytics. In their research, universities

could benefit from the vast real-life data sets and tools on the platform while in return, the universities could provide some of the AI models they are coming up within their research. With universities, the commercial approach may not be as clear as with the commercial companies, but it could be worth exploring as the change management interviewee speculated: *"Universities could be an interesting type of partner to look into especially in terms of AI related topics. They are a central contributor in the development of AI."*

Third, data provision companies would enrich the potential to create a wide range of content to the platform. In this categorization, these are not directly considered into the industry specific or non-industry specific development companies. That is due to the distinction, that these data provision companies enhance the development for other companies, rather than developing content themselves to the end-customers. Combining data from multiple different sources would enable the developers to create significantly more sophisticated content and thus also provide customers with more value. The necessary data could range all the way from weather data to social media data, depending on the content and end-customer's needs. For example, combining weather data with network performance data could further improve the ability to optimize certain KPIs. As the analytics development responsible from the focal company put it: *"The limitations of only working with case-specific customer data are somewhat unnecessary, as there is an entire universe of companies specializing in providing data from various sources. We should be looking into getting these players into the ecosystem."* The interviewed offering management responsible had a similar view: "*By involving companies, who specialize in data provision, the customers could see totally new solutions, in which telco data and non-telco data would be combined in a meaningful way."*

The most prominent types of go-to-market partners to the focal platform ecosystem. In the focal platform ecosystem, the role of go-to-market partners, also called sales partners in this thesis, would be to sell the focal platform and the complementary content atop of it to the end-customers. This means that they would provide improved sales reach towards end-customers. The identified sales partners could be categorized into the professional service companies and the communications service providers.

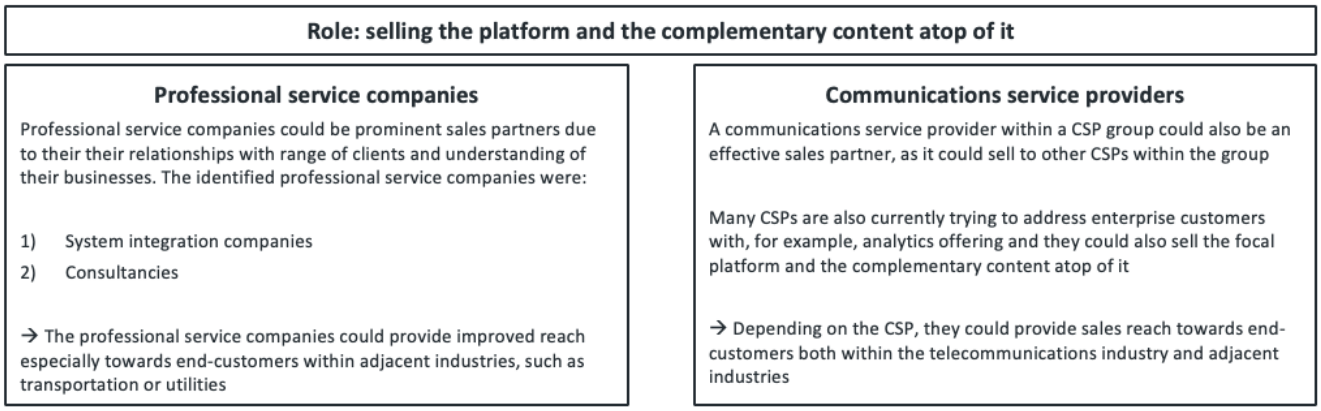

Figure 6, the most prominent types of go-to-market partners to the focal platform ecosystem

First, the professional service companies could provide opportunities, especially in reaching end-customers within adjacent industries, such as transportation and manufacturing. Additionally, accessing large scale infrastructure projects, such as construction, management and maintenance of an electrical grid, through an engineering consultancy would be an attractive scenario. The interviewed change management responsible was one of the interviewees who backed this up: *"Providing our analytics, virtualization and automation platform to large scale infrastructure projects through engineering consultancies or system integrators would be an ideal situation for us due to the enormous size that just one project can have."* Especially this type of partners could help in expanding to other industries through their expertise and relationships within the industries, in which the focal company has not traditionally been focusing on.

In addition to the go-to-market role, many larger consultancies possess technical capabilities that they could also leverage in the development of complementary content to the platform. For many of these larger players model 3, in which they could sell their own content with the platform would likely be the only model in which they would be willing to participate in. The delivery management interviewee mentioned this: *"It might not be a trivial task to align incentives with the largest consulting powerhouses such as [company names...]. Especially if they are not allowed to develop their own content and sell that along with the platform as well as sell any other content that is made available by other content developers. Thus, model 3 would probably be the only one in which we could see these players present."*

Second, CSPs could also be interesting partners in the go-to-market dimension. Taken that the primary focus of the focal company is in the telecommunications industry, working with the CSPs and having them as the go-to-market channel would provide a rather natural setting. CSPs could sell the platform and the content to other CSPs, especially within large, international CSP groups. The analytics technical management responsible from the focal company described one potentially effective scenario: "*Some of the largest CSP groups are creating internal marketplaces, for example, to analytics use cases and getting access to those through one of the subsidiaries in the group could provide significant sales with limited effort."* On the other hand, many CSPs are also trying to expand their business to new industries to find novel revenue sources, and thus, they could also act as sellers in the adjacent industries.

4.3 Beneficial outcomes of the interventions

An expanded platform ecosystem that could feature development partners, sales partners and sales portal or marketplace for the complementary content could provide benefits to end-customers and the focal company. These benefits are covered in this section. The rationale to explore the benefits of the interventions was to create an understanding of how the interventions could improve the situation with the platform and the business around it.

4.3.1 Beneficial outcomes to end-customers

Beneficial outcomes to end-customers from opening up in the development dimension – intervention 1. Two key categories of benefits through intervention 1 could be identified from the interviews: the variety related benefits and the utility related benefits. The first category, benefits related to the variety of the complementary content, could be further broken down into three sub-categories. First, having a wider complementary content offering would increase the value that the customers could get in return for the investment of getting the platform deployed. This is rather similar to the mobile phone market, where a substantial portion of the value comes from the applications and the investment to a mobile phone is more justified with a considerable selection of available applications. The offering management interviewee from the focal company commented on the relationship between the value of the platform and the variety of the available content: *"The more high-quality [complementary]*

content we have atop of the platform, the more value the customers can get through their initial investment of getting the platform deployed." Within the first variety aspect would also fall the claims of customers potentially gaining access to more innovative and thus more valuable offering through the introduction of development partners. As the delivery management interviewee said: *"Having a larger pool of developers within the ecosystem should also result in more ideas and more innovative content compared to just having internal teams conducting the development."* The same claim was backed up by the sales manager of a potential ecosystem partner company: *"By involving development partners into the platform ecosystem, customers can access expertise and perspective from many different players, resulting in higher variety and even more innovative content."*

Second, for the end-customers in the telecommunications industry, the variety benefits could materialize especially with complementary content that has too low revenue potential for the focal company to allocate resources to develop. The focal company has concentrated its limited complementary content development resources to only cover content with highest revenue potential in absolute terms. This means that a wide variety of content with smaller revenue potential could be added the offering by development partners. Customers would still find this content valuable and the potential revenue from that content would be very attractive for many smaller players. The analytics technical management responsible explained the situation: *"There is a significant amount of [complementary] content that we simply cannot develop ourselves, since the revenue potential is too low for that particular content and we cannot allocate our resources to it. However, many of our customers would be extremely interested in some of that content, such as [content examples]. While the revenue potential for that content is not high enough for us to allocate resources to, there are be many smaller players, who would be very interested in the size of the business they could receive by developing it."* This means that there would be significant potential to provide end-customers with increased variety or even start offering an entirely new content category in the lower revenue potential range within the telecommunications industry. Even though this aspect was directly brought up only in one formal interview, it got strong support in many informal discussions.

Third, the variety benefits to the end-customers could strongly be seen in the adjacent industries space, where the focal company has previously not focused on. Especially the industry specific development partners with a focus on any of the adjacent industries could bring more non-telco content to the potential end-customers in those industries. This would be enabled by their expertise and capability to conceptualize solutions to the end-customers pain points, that they understand and know how to tackle. As the delivery management interviewee mentioned: *"Development partners could bring more understanding to the enterprise segments [= adjacent industries] and create content that would attract and provide high value to the customers in those industries that we are not yet addressing that extensively."*

The second category of benefits to end-customers from opening the development dimension up to partners is the utility related benefits. There are further three sub-categories under the utility category. First, end-customers could expect shorter response time to their explicit needs and faster innovation frequency. Thus, the wider development ecosystem could strengthen the technology push, but also improve the ability to meet market pull, compared to the current in-house only content development approach. As the portfolio management responsible stated: "*We have only so much resources and capacity currently to produce the [complementary] content to the platform and having an ecosystem of development partners could significantly increase the speed of response to market needs.*" Additionally, many interviewees anticipated that the dawning 5G future will only increase the required frequency of innovation regarding the complementary content. This is a result of connectivity becoming even more of a general-purpose technology than it is today, resulting in a vast increase in the applications of connectivity. Thus, many potential customers, especially within the telecommunications industry, could be overwhelmed by the speed and scope of change that will take place with 5G and being able to stay ahead of the curve and help those customers requires extraordinary speed in response. The vice president of sales of a potential ecosystem partner company commented on the issue: *"In the 5G future, customers will be asking for an extensive offering of services in analytics, virtualization and automation and once they see a need, they want the solution immediately."* Thus, especially in the rapidly evolving future, customers could benefit from having access to a comprehensive development ecosystem through the focal platform.

Second, taken that one company has a particular expertise profile, there may currently be a need for customers to resort to multiple different vendors in their analytics, virtualization and automation needs if the expertise of multiple companies is not brought under one roof. By introducing development partners to the platform ecosystem, the end-customers may be able to experience significant utility gain by being able to find content to suit most, if not all, of their needs from one place. The analytics development responsible described this prominent opportunity: *"A customer could save a significant amount of effort, if instead of working with many analytics companies, it could satisfy all of its needs through one interface. By getting some those independent analytics companies aboard, we could act as that interface."* However, some customers may prefer to have a few different providers as they are not willing to lock themselves down to a single one. The head of IoT of a potential ecosystem partner company described: *"Customers can be hesitant to make heavy commitments to one player and its solution, especially if it is not extremely established in the industry."* This should not be such a significant issue in the telecommunications industry taken the highly-regarded status of the focal platform, but it might be something to keep in mind while aiming to expand to adjacent industries.

The third and last point regarding utility is the potentially decreasing content prices that the introduction of the development ecosystem could bring. Some of the potential development partners could already have their content ready, and with somewhat limited effort, they could make it also compatible with the focal platform. This type of approach, in which the partner would be multi-homing their content could, in some cases lead to price reductions as the more extensive attainable volumes could enable price reductions. Also, different development companies have varying expertise profiles, and some may be able to produce some content with significantly less effort than others. A new player with specific expertise might be able to bring some content to the platform with lower prices than others previously. The interviewed offering management responsible mentioned: *"Whereas we are extremely strong ourselves with most of what our customers need, the cost of innovation within certain fields could be significantly lower for some other companies*. *This could eventually translate into lower prices to our end-customers."* While the mechanisms behind the pricing are much more complex than what is discussed here, the ecosystem model could also lead to customer benefits in this front.

Table 4, beneficial outcomes of the intervention 1 to the end-customers

	Open development dimension – intervention 1
Variety related benefits	Being able to leverage a higher variety of content with the same platform deployment investment
	Gaining access to an entirely new category of content in the smaller revenue potential content, that the focal company cannot currently allocate their resources to develop
	Potential end-customers in adjacent industries could especially gain more content for their needs
Utility related benefits	End-customers could expect faster response to their needs and increased innovation frequency through the increased development capacity of the ecosystem
	End-customers could find everything they need in regards e.g. analytics, from the focal platform with significant development ecosystem
	End-customers could potentially see lower prices

Beneficial outcomes to end-customers from opening up in the go-to-market dimension – intervention 2. The potential benefits to end-customers were considered to more substantial when opening up in the development dimension compared to opening up in the go-to-market dimension. The interviewed analytics sales responsible even claimed: *"There is absolutely no added value to the end-customer if we consider having partners sell the platform or the [complementary] content to them."* Also, the delivery management interviewee was quite sure that opening up the development dimension would provide more benefits to the end-customers: *"Obviously more value to end-customer would come from introducing development partners to the ecosystem rather than sales partners. It is the development partners ideas and innovation that we should be looking for."* While these claims can have some ground to them, there were still three utility related potential benefits to end-customers that the interviewees identified with the intervention 2.

First, end-customers could get access to the focal platform and its complementary content through their trusted vendor without another vendor-relationship with the focal company. Thus, the trusted vendor could bundle the focal platform and the necessary complementary content with other offerings it has access to and provide a more exhaustive set of services to the end-customer through merely one client-vendor relationship. As the change management responsible said: *"Customers could get [the focal platform name] and the complementary content from their trusted seller and there would be no need for the end-customer to have a contractual relationship with us. In this case, the customer's trusted seller would have the potential to act as a one-stop-shop for the customer's needs in this field, thus providing utility through simplicity to the customer."* This could thus provide the end-customer with services they were not earlier able to get through their trusted seller or alternatively if they had multiple vendors earlier, they could probably cut down to only one. Additionally, some end-customers, especially in other industries than telecommunications, may not even be able to recognize the focal company as a provider of an analytics, virtualization and automation platform. They may miss out on some services that may be beneficial for them. A sales partner with an understanding of both the focal platform and the complementary content atop of it as well as end-customer needs in other industries could then match these two in a novel way that the customer could benefit from.

Second, the end-customer could also gain utility related benefits if the focal platform and the complementary content would reach it through a local sales partner in the ecosystem. The local sales partner in the customer location could provide at least two benefits. First, they could interact with the customer's local language by default, which could prove valuable especially in the parts of the world, where the local language remains as the standard business language, and it is not English. The analytics development responsible stated: *"In many parts of the world, customers still expect or at least value interaction in their own language."* The local sales partner could also reduce the price to the end-customer, if it is competent enough to carry out the deployment of the platform and utilizing the complementary content for the customer, in cases where the customer is not capable of doing this themselves. This could derive from the reduced need for the centralized focal platform deployment team to travel for the deployments. The analytics development responsible also commented on this: "*In certain markets, which are remote from the current delivery center, it could be more cost-effective*

to have local sales partners handling the deployments of the platform to end-customers." Furthermore, the change management interviewee also speculated with potential to have reduced price for end-customer: *"We could see a situation, in which the sales partner is willing to take a little hit to its margins, while bundling our offering to theirs, if they could increase their volumes with the new bundles that way."*

Finally, the sales portal for the focal company's complementary content in model 2 and a marketplace for also development partners' content in model 3 could provide utility related benefits to the end-customers. The convenience and efficiency offered through the visibility to the available complementary content offering and self-serviceable content were the most prominent benefits that came up in the interviews. The benefits would basically apply for the customers who already have the focal platform deployed and could then access the sales portal or the marketplace featuring the available complementary content. With content that could be self-serviced, customers could gain significant utility benefits through convenience as they would not have to request for the content from the focal company or a sales partner in a traditional manner. Also, such a portal could enable the sales partner to conduct efficient sales by having the visibility to all the available complementary content through the portal or marketplace. The interviewed business development responsible mentioned: *"The market is moving more and more towards a self-service type of approach with the lead of AWSs and Azures of the world. That approach provides convenience and efficiency to the customers."* However, not all of the content could probably be sold through a digital marketplace or portal – at least not in a self-service manner - as the analytics sales interviewee stated: *"Many of our customers would not at least yet be comfortable acquiring the content through a marketplace. We need to maintain a traditional face-to-face sales approach for most of the content in order to convince the end-customer to buy."*

Table 5, beneficial outcomes of the intervention 2 to the end-customers

	Open go-to-market dimension – intervention 2
Utility related benefits	Convenience through end-customer being able to access the focal platform and the complementary content through their trusted vendor
	Local sales partners could interact with customers in their local language and reduce the price of platform deployment through reduced need for travel
	Efficiency and convenience through a sales portal or marketplace, especially with self-serviceable content

4.3.2 Beneficial outcomes to the focal company

Beneficial outcomes to the focal company from opening up in the development dimension – intervention 1. There are two categories of beneficial outcomes to the focal company associated with the intervention 1: customer acquisition and loyalty benefits, and benefits to the 5G future. The first category of customer acquisition and loyalty benefits has two items within it. First, the potential development ecosystem could bring capabilities and capacity to the development of the complementary content. This could well complement the existing expertise that the focal company already possesses and result in a more exhaustive offering atop of the platform. It could also increase the speed of innovation for the complementary content through an increased number of developing entities. Thus, there could be both complementary content variety and development time-related improvements as also discussed in regard to the end-customer benefits. These could translate into higher value of the platform to end-customer, which in turn could make the customer acquisition and retention easier. This was among others stated by the sales manager of a potential ecosystem partner company: *"You [=the focal company] could get access to a significantly larger pool of content through opening up to partners in the development dimension. This would likely attract more customers to use the platform as it would have content to address a range of customer needs."*

The benefits for both the end-customers and the focal company could be well aligned in terms of the content and its variety, taken that the development partners would be mainly addressing the missing

gaps in the complementary content. If thee development partners, however, brought substituting content to the platform, there could also be more apparent risks to the focal company. Then, the consideration is whether the focal company wishes to ensure the success of the platform or the short-term success of its own complementary content business. In case the platform is considered the primary business, having the best-of-class content on the platform in all possible categories regardless of who has developed it, should be the goal. If the complementary content is, however, considered the primary business, then more control over what content is allowed to the platform should be enforced. The analytics development interviewee also showed some caution: *"We might be cannibalizing our [complementary] content business by bringing development partners into the platform. This has to be though carefully before opening up."*

Second, the customer acquisition and loyalty could be improved, through the branding benefits that the platform could expect, if it could attract, for example, the leading analytics or AI companies to the ecosystem. As the interviewed change management responsible stated: *"It would be beneficial for us to be associated with some of the leading analytics and AI companies by having their content atop of the platform. In addition to gaining great content from those players, their presence in the ecosystem would also provide marketing value for the platform itself."* Seeing these top players working with the focal platform could further improve the status of the platform in the eyes of both end-customers and other potential partners.

In the second category, the beneficial outcomes are related to future aspects with 5G technology. As one of the leading players in the telecommunications industry globally, the focal company will be heavily involved and among the most central players in the upcoming change brought by the 5G. The vice president of sales of a potential ecosystem partner company, who is also involved in the telecommunications industry, took a firm stand on the 5G future: *"In the upcoming world of 5G, there will not be any single player, who could survive let alone thrive alone. The customer needs will be so diverse, and they will need to be solved so fast, that a sharing-based development ecosystem, in which different players do not always have to start their development from scratch, is a must!"* Thus, building an ecosystem around the platform now, in the dawn of the 5G would provide a more solid foundation

for future success. This was further backed up by the interviewed sales manager of a potential platform ecosystem partner: *"5G will be very different from the previous generations, in which the largest vendors have been able to serve their customers for the most part with limited contributions from partners. It will not be the reality with 5G – there will have to be partners involved."* Thus, the largest telecommunications network vendors could still remain as the keystone companies in the industry, but they will increasingly need contribution form partners in terms of services and products they are serving their customers with. In the 5G world, if the platform could indeed attract a significant ecosystem that can produce a wide variety of high-quality content, it could act as a go-to-platform for analytics, virtualization and automation related needs especially in the telecommunications industry. That role and position in the market would obviously be highly desirable.

Table 6, beneficial outcomes of the intervention 1 to the focal company

Open development dimension – intervention 1	
Customer acquisition and loyalty benefits	Increased variety of complementary content and faster innovation frequency through partner capabilities and development ecosystem capacity increase
	Branding benefits of working with cutting edge AI or analytics companies could attract more end-customers (and partners)
5G future benefits	No single company will be able to foresee all the potential customer needs nor will anyone have the capacity alone to address all of them in the analytics, virtualization and automation field
	A highly desirable role to be the go-to-platform for analytics, virtualization and automation needs, while many customers will be overwhelmed by the change induced by the introduction of 5G

Beneficial outcomes to the focal company from opening up in the go-to-market dimension – intervention 2. Three categories could be identified for the beneficial outcomes to the focal company from opening up in the go-to-market dimension: sales reach benefits, partner capability benefits and sales portal and marketplace efficiency benefits. Three beneficial aspects could be identified to be

associated with the increased sales reach. First, there could be some low hanging fruits available by choosing the right sales partners. As the analytics technical management responsible said: *"Having a prominent CSP within a CSP group as a sales partner could provide a very effective channel to market as it could with limited effort reach to other subsidiaries within the group."* In addition to improved sales reach, this type of approach could result in significant efficiency, especially in cases where the sales partner company itself is familiar with the platform and the content, resulting in a limited need to educate it.

Second, the increased reach through sales partners could lead to upselling opportunities. Especially in cases, where the end-customer of the platform and its content has not been familiar with the focal company and its offering earlier. This could, for example, be the case in the adjacent industries, where the customer would not probably initially recognize the focal company as a provider of analytics, virtualization and automation platform. However, for example, a consultancy in an adjacent industry could open doors for also the sales of some other services or products from the focal company by introducing the focal platform to the end-customer. The sales manager of a potential ecosystem partner company said: *"Through sales partners, you [=focal company] could reach customers that would not traditionally consider your offering. In addition to the analytics, virtualization and automation platform, you could gain access to the market for also your other products, such as private networks."*

The third benefit in this category is the potentially higher overall market share, that the increased sales reach could bring if it translates to more sales. The interviewed sales manager of a potential ecosystem partner company claimed that: *"Involving sales partners could be a good way to increase the overall market share of the platform as it certainly would bring more exposure to the market."* The higher market share could lead to an even higher profile for the platform and help in accessing industries outside the telecommunications. Additionally, due to the potential indirect network effects, that could be present especially in model 3, there could be more interest on the platform also on the development side as the addressable market through the platform would be considerable enabled by the high market share.

The second category of beneficial outcomes is related to the capabilities that the potential partners could bring with them to the ecosystem. In addition to direct sales, the formulation of the value propositions and the technical deployment of the platform to the end-customer could be the two activities, with which the focal company could benefit from the partners in the go-to-market dimension. Especially in the adjacent industries, the formulation of the value propositions was seen as a potential challenge for the focal company. It was thought that sales partners, such as consultancies, could fare better in it. Regarding this matter, the analytics technical management interviewee stated: *"In some cases, we do not really know the businesses of the potential end-customers in the adjacent industries that well. This makes it difficult for us to know the pain points of these customers that our solutions should solve, even though we could technically solve them. Consultancies that are working in these industries would, however, have this knowledge and could formulate the value propositions in a way that they would address these customers and their needs."* The deployment of the platform requires some expertise, but many external players could well do that. This can be a time-consuming task that takes resources from the focal company and could even stand in the way of increasing the sales volumes. Thus, having sales partners who can also deploy the platform could be highly beneficial for the focal company. The vice president of sales of a potential ecosystem partner company mentioned: *"You could also leverage partners in the platform deployment. Many potential partners around the globe would have the necessary capabilities to do that. This could help you in scaling."*

The final beneficial outcome category in the go-to-market dimension is the potential efficiencies associated with the sales portal or marketplace type of approach. There would be enormous potential for efficiency gains, especially with content that could be self-serviced with a click of a button from the sales portal or marketplace with the platform. The commercial management interviewee stated: *"With a high-quality marketplace a large share of the sales efforts could be cut out from the equation, resulting in significant cost savings. This would also increase the convenience to the end-customer, which would result in better customer experience."* This means that the sales portal or marketplace could provide opportunities to reduce the spend in traditional sales activities.

Table 7, beneficial outcomes of the intervention 2 to the focal company

Open go-to-market dimension – intervention 2	
Sales reach benefits	Relatively low effort sales through certain partner types, such as CSPs within CSP groups
	Upselling opportunities through sales partners, especially in adjacent industries
	Higher overall market share leading to improved profile of the platform
Partner capability benefits	Sales partners could aid in formulating the value propositions
	Deployment of the focal platform could also be done partners reducing the in-house resource intensity
Sales portal and marketplace efficiency benefits	Improvements in the efficiency of sales by providing self-service content to end-customers through a sales portal or marketplace

Beneficial outcomes to the focal company applicable to both interventions 1 and 2. In addition to the identified beneficial outcomes to the focal company in these two dimensions separately, there are two financially related beneficial outcomes, that could be associated with the opening of both the development and go-to-market dimension. First, the focal company may be able to increase its overall profitability with the platform. For example, considering a situation, in which the focal company plays a smaller role, such as end-customer consuming partner developed content with the platform or sales partner selling existing content developed by the focal company. In both of these cases, the focal company obviously has to share the revenue with another party, but there are also rather low variable costs associated with the transaction for the focal company. Thus, the share of revenue it receives, translates on a larger portion to profit. Also, these transactions do not require resources or committed personnel from the focal company in the same way as if it had an end-to-end role. The interviewed consultant industry expert stated: *"These platform ecosystem models enable transactions, from which the focal company can make almost pure profit from. This could increase the overall profitability of the business if, in many enough transactions, the focal company receives a share of the revenue without having to put additional effort into the particular transaction. In terms of a real-life example, Apple is*

employing a revenue share model in its App Store, where it receives a certain percentage of the 3rd party application sales. This share of the revenue is basically pure profit for Apple."

The second benefit is related to the resource allocation of the focal company. With both of the interventions, taken that they would be successful, there might be potential for resource re-allocation and reducing the costs associated with either the development of the complementary content or the sales. The sales vice president of a potential ecosystem partner company mentioned regarding the development dimension: *"There is a chance that you [=the focal company] could potentially reduce your spending on the development of the complementary content or have a chance to even further focus your resources on certain types of content as the ecosystem could fill in the content gaps."* Similar potential could be seen in the sales dimension. Even though building a thriving ecosystem might open avenues to reduce resources within these two areas, it requires resources on other areas as will be discussed in the following section.

Table 8, beneficial outcomes to the focal company that are applicable with both interventions

General – applicable to both interventions	
Financial benefits	Allows for the opportunity for higher profitability in cases, where the focal company does not play an end-to-end role
	Potential to reduce internal spend on sales efforts or R&D of the complementary content

4.4 Mechanisms for materializing the beneficial outcomes

To merely claim that an intervention has been carried out does not result in the beneficial outcomes identified in the previous section. The interventions themselves are abstract constructs and there are mechanisms through which the potential beneficial outcomes could actually be reached. This section concentrates on those mechanisms. For the intervention 1, this thesis proposes a development dimension expansion mechanism and for the intervention 2, a go-to-market dimension expansion mechanism.

Development dimension expansion mechanism. Intervention 1 considers opening up the boundary towards development partners to allow them to contribute to the complementary content creation to the focal platform. To reach the beneficial outcomes discussed in the previous section, the opening of the development boundary must lead to attracting development partners and enabling their contributions. Only this can lead to having additional partner developed complementary content atop of the platform, which then could lead to the beneficial outcomes. The beneficial outcomes themselves can further lead to the intensification of this mechanism if the benefits to the focal company and its end-customers are great enough. For example, this could mean that the focal company would be willing to further invest in partner attraction and enablement. On the other hand, the self-reinforcing cycle could be even more direct as the benefits to the end-customers would grow with the additional complementary content appealing to more and more end-customers. This increased addressable market through the platform could attract development partners directly. In terms of the development dimension, this section concentrates on how the focal company can attract development partners but also on the requirements for the company to enable a functional ecosystem beyond attraction in the development dimension to induce the expansion mechanism.

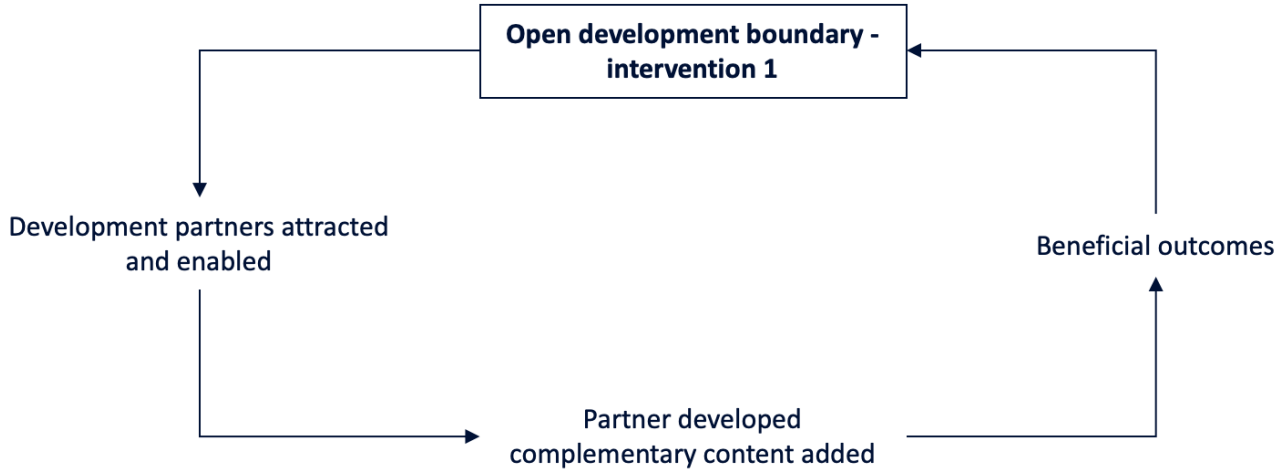

Figure 7, development dimension expansion mechanism associated with intervention 1

Go-to-market dimension expansion mechanism. Intervention 2 considers opening up the boundary towards consumption by involving sales partners as well as potentially also creating a sales portal or a marketplace for the complementary content to serve go-to-market purposes. In order to reach the

beneficial outcomes discussed in the previous section, the intervention 2 must lead to attracting sales partners and enabling them to sell. Only then these partners could actually conduct sales and the beneficial outcomes could be reached. Additionally, if the focal company would decide to create a digital sales portal or a marketplace around the platform for the complementary content, that would not itself be enough to reach the benefits if the sales partners or end-customers would not utilize them. In the go-to-market dimension, the beneficial outcomes can intensify the mechanism in a self-reinforcing manner. For example, additional revenue to the focal company caused by the sales partners could lead to increasing investment to the sales partners attraction or enablement. With the go-to-market dimension, this section concentrates on various elements that could attract sales partners and on the requirements for the focal company to enable an ecosystem in the go-to-market dimension. Also, requirements to make the sales portal or marketplace work are discussed.

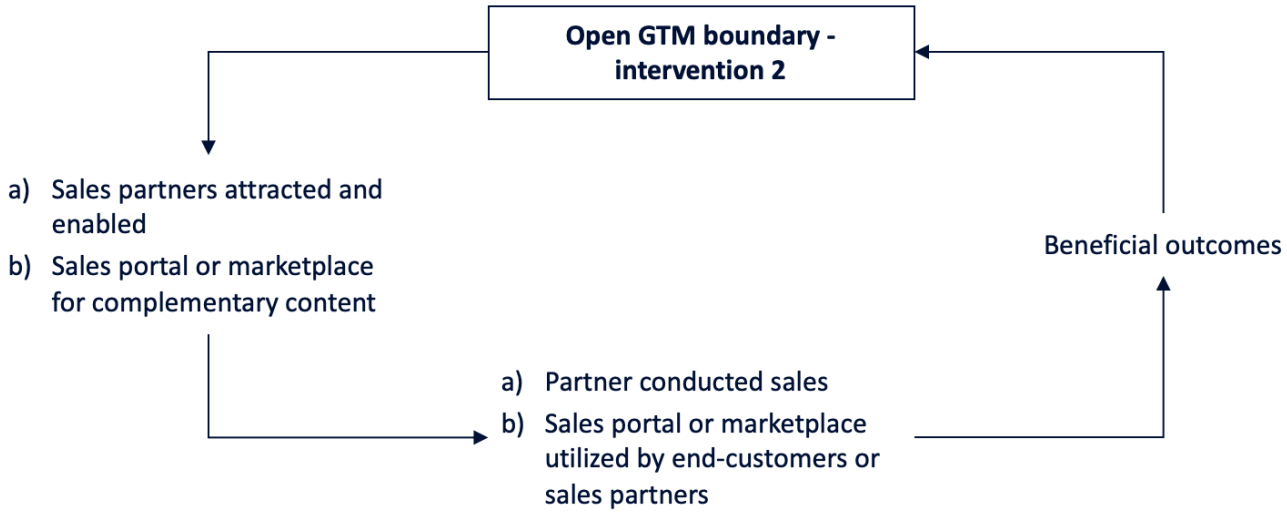

Figure 8, go-to-market dimension expansion mechanism associated with intervention 2

4.4.1 Attracting platform ecosystem partners

Attracting partners to contribute to the platform ecosystem is crucial to the success of the interventions in terms of reaching the potential beneficial outcomes. The focus is on the factors that could attract the ecosystem partners to participate in the focal platform ecosystem. In this subsection, the attraction factors are divided into those that differ between the development and sales partners, and to those

that apply similarly to both. The factors that differ between the development and sales partners are described first.

Focal platform ecosystem attraction factors that differ between development and sales partners. The attraction factors that take different forms depending on whether the partner is a developer, or a sales partner can be grouped into three different categories: financial factors, enablement and technology factors, and lastly factors related to direct network effects. In terms of the financial attraction factors, the identified primary business rationale for the development and sales partners differ, even though both would be eventually driven by the opportunity to generate more revenue through joining the platform ecosystem. For the development partners, the primary business rationale would be to gain a go-to-market channel, through which their content could reach end-customers. This means that the more addressable market the focal platform can provide for the partners' content, the more attracted they would be to join. As the business strategy interviewee said: *"We have great access to the CSPs, and development partners will be attracted by the possibility to access customers through our sales reach."* For smaller players it could result in enormous financial success if they could get their content atop of the platform as stated by the analytics technical management responsible: "Especially *for SMEs to be part of our development ecosystem could be a jackpot. It could put them on a growth trajectory they would not have considered possible without. This is where I see much potential."*

On the other hand, for the sales partners, the primary business rationale would be to get access to sell the focal platform with its complementary content. If the platform and the complementary content associated with it are complementary to the sales partner's existing portfolio, then there is an opportunity for additional sales to their existing customers. This was stated by the analytics sales interviewee: "*Our [=focal company's] portfolio, including the platform and the complementary content, would attract players who could complement their offering with it. Especially larger players, such as consultancies, are aiming to have an all-encompassing offering so that they could offer their customers with everything they could need.*" Also, broadening their sales portfolio could enable an entry to new industries for them, which would also have potential to increase their sales as said by the sales manager of a potential ecosystem partner company: *"With additional offering, a sales partner could tap into new*

customer segments they have not been able to serve earlier." Thus, the foundational attraction factor for sales partners in terms of the business rationale is the ability to increase their sales either by allowing them to gain a higher share of the wallet from their existing customers or by tapping into entirely new customer segments.

Partner could also be attracted by investing in them, especially at the beginning of their participation in the platform ecosystem. Development partners could be attracted by investing in providing them with inexpensive or even free sandbox development workspaces, that they could use to create content to the platform. The offering management interviewee considered this as a potential differentiation factor in the market: *"Many players could be attracted by providing them with a free or at least close to a free sandbox environment, in which they could work. This could also help us in setting ourselves apart from some of the competition. It would require investment, but in the long run, it could pay off."* Also, the analyst industry expert mentioned direct investment as a way to attract development partners: *"Setting up an incubation fund, from which direct investments could be made to the most prominent partners would likely result in traction around the platform."* In terms of the sales partners, the investment was also considered as a way to attract partners but differently. In the sales dimension, the investment could be carried out in the form of providing free digital sales portal integrations as mentioned by the change management interviewee: *"Investing in making the start for the sales partners as inexpensive and easy as possible would definitely help in attracting them to the platform ecosystem. We should offer, for example, free integrations to their sales portals or other systems."* Thus, visible investment to partners could lower their barrier to join the platform ecosystem and complement other attraction factors, potentially resulting in successful partner acquisition.

Finally, in terms of the financial attraction factors, an attractive commercial model was considered essential. Even though the preferred commercial model was the same for both development and sales partners, there was also some difference in the options. For the development partners, there were two feasible alternatives identified. The first being the revenue share model, in which the revenue from the partner developed content would be shared between the developer and the focal company. The second would be licensing of the partner developed content. The revenue share would, however, be a more

suitable alternative if considering a real ecosystem or partnership model, not a traditional supplier-buyer approach. As the sales manager of a potential ecosystem partner company put it: *"Revenue sharing model would induce significantly more business engagement for the development partners and would motivate them more to do their very best, as their income is dependent on the sales of the content."* Also, the focal company could generate revenue by imposing subscription fees on the development partners, but that was not preferred by any of the interviewees, at least not in the early stages with the intervention 1. Actually, quite the contrary as described above with the investment to development partners. In terms of sales partners, the revenue share was considered the only alternative to be attractive to them. The sales manager of a potential ecosystem partner company said: *"A success-based approach would really motivate the sales partners and thus revenue share is the ideal commercial model."* In conclusion, with both the development and sales partners, the revenue share should be a fair approach to attract partners. It could even in the early stages of the interventions be exaggerated to partners' benefit.

The enablement and technology related attraction factors could also play a significant role in attracting both the partners. As the first item in this category, partners in both groups would be attracted by an easy involvement, meaning that they would have the means to learn and start working efficiently soon after joining. The means to achieve this however differ between development and sales partners. For the development partners there were two key items, which could ease their involvement. First, extensive and high-quality training, examples and instructions would be crucial for an efficient start. The change management interviewee provided the Android ecosystem as a benchmark: *"Even though [the focal platform name] is significantly different to Android, we should still aim at making the start for a developer as simple as Android has made it for the mobile application developers. They provide immaculate instructions that enable a very low barrier to entry for the developers."* Second, in case the potential development partner would already have existing content that is technically compatible with another platform in the market, the opportunity to multi-home that content as effortlessly as possible on the focal platform could attract many development partners. The sales manager from a potential platform ecosystem partner stated: *"Especially partners that already have suitable existing content would likely be very interested in bringing it atop of the platform if multi-homing was encouraged and*

made as simple as possible." The reason for this is apparent, as the development partner could gain access to potentially new end-customers with limited effort by making their solution compatible with another platform. Both of these items could lower the barrier for participation as they would reduce the investment and time to become productive.

For the sales partners, easy involvement was also identified as an essential attraction factor. For them as well, two key items were identified to contribute to the ease of involvement. First, the value of the platform and the available complementary content, would have to be articulated in a way that they are as effortless as possible for the sales partners to learn. The analytics technical management responsible stated: "*We need to be able to explain the solutions in a simple manner to make the model with sales partners work. We need to focus more on explaining the value of the platform and the use cases [=complementary content] to these sales partners rather than concentrating so heavily on the technology that achieves the value. Otherwise, the partners will not be able to sell to end-customers.*" To deliver this understanding to the partners, documentation, as well as training, will have to be organized. The training sessions could even be more of a workshop type in nature, as some of the potential sales partners might be more sales and marketing oriented and thus fare better in formulating the value propositions as the portfolio management responsible said: *"In some cases we could really benefit from some help in formulating the value propositions of our solutions to the end-customers. Some consultancies could be a great help in this sense."* Second, integrations with other customer systems should be made as simple as possible, so that it does not stand as a hurdle in the way of sales. The offering management interviewee said: "*We should make the solution stitching and integrations with other systems even simpler. That would, in a way, open up more market for the sales partners, but also for us.*" Additionally, the sales manager of a potential ecosystem partner company claimed that being able to multi-home the complementary content of the focal platform on other platforms, could make the selling for the sales partners much more straightforward: *"Being able to sell only the complementary content so that it could be utilized on other platforms would be attractive for many potential sales partners."* This could, for example, allow the sales partner to continue selling another platform, but it could complement it with content originating in the focal platform. These would both,

similarly to the development partners, reduce the effort that it would take for the sales partners to start earning.

As the second attraction factor in the enablement and technology category is the extraordinary technical support to partners as it can substantially increase their productivity and sales. For the development partners, the high-standard service level agreements (SLAs) with the platform and the workspaces will enable consistent experience and low downtime. Also, in cases of issues, the support associated with the focal platform could be a genuine separating factor in the market. The analyst industry expert claimed: *"Technical support is still sometimes neglected by some players or only provided in a reasonable way to the largest partners in some platforms. However, for example, Nvidia took a different approach to this and really invested in the support across their partner pool. The word spread and more companies wanted to work with Nvidia. This was among the factors that have provided such a momentum to the company."* For the sales partners, the technical support would have two sides. The first being that if the platform, as well as the content atop of it, have competitive SLAs, then the services that they would be selling would themselves become more attractive, and thus also partners would be more attracted. On the other hand, the technical support would materialize in the deployment and content utilization after the sales have occurred. These should be included in the basic SLAs as the cloud strategy responsible said: *"Everything from the delivery and deployment of the platform to the utilization of the content should be included in the SLAs and not considered separate entities."* However, the sales partner could well conduct the delivery and deployment for the end-customer, and thus the focal company should provide training to enable this. Having an efficient training process with excellent support available in case the partner wants to carry out these could be very attractive as well.

Finally, in terms of the enablement and technology related factors, the focal company's domain expertise might be something that attracts partners. For the development partners, this could be a key factor, since especially the non-industry specific development companies need a way to access specific industries with their generic solutions. Thus, industry specific assets could be extremely attractive for them as the analyst industry expert stated: *"Many AI, analytics and software companies would find the*

telco specific dummy training data sets extremely valuable and that is something you [=focal company] should really pay attention to. In my opinion, this is among the key competitive advantages that you can have and provide to your potential partners." These will allow the development partners to modify their analytics and AI models to match the industry, improve their accuracy and ready them for the market. The sales partners would gain access to some of the industry expertise through the platform and content as well as the potential training that the focal company would provide. This could allow the sales partners to access the telecommunications customers. The analytics development responsible said: *"The sales partners could be attracted to enter a new market and through us, they could get the platform and its complementary content to their portfolio as well as potentially the knowledge to effectively sell them to the customers."* Obviously, outside the telco industry, many of the sales partners could have more expertise and understanding of customer needs than the focal company itself. However, the telecommunications industry is large and both development and sales partners could be attracted by the domain expertise that the focal company and the platform could offer to them.

Attraction factors related to direct network effects were also identified, but only among the development partners. This means that the two identified factors could grow in attractiveness for the development partners as their number grows in the platform ecosystem. First, a vivid developer community could attract more developers to join the ecosystem as the change management interviewee mentioned: *"The developers could value a community of peers, similarly as we see with the Android ecosystem."* The attraction of this factor could be compared to some of the social media sites, which become more attractive as more and more people join them. Second, the more extensive the development ecosystem would be, the more efficient it could become in terms of innovation and content creation. Some content can be used as building blocks for other content and the development partners could make those also available to others to buy and use. The vice president of sales from a potential ecosystem partner company commented: *"A sharing-based approach in the content creation could speed up the development significantly. This would mean that developers could leverage each other's contributions in creating new content."* Thus, direct network effects could play a role in attracting more development partners to the platform ecosystem.

Table 9, focal platform ecosystem attraction factors that differ between development and sales partners

Factor	Development partners	Sales partners
Financial factors		
Primary business rationale	Access to a go-to-market channel → revenue	Access to sell the platform and the complementary content → revenue
Visible investment in partners	Free or inexpensive development environment, or direct grants to develop content	Free customer portal integrations
Attractive commercial model	Revenue share or licensing	Revenue share
Enablement and technology factors		
Easy involvement	Among others: instructions, examples, training, multi-homing	Among others: ready-to-use sales materials, training, integrations to common customer systems
Extraordinary technical support to partners	High standard SLAs and supporting the development partners with their platform related issues	High standard SLAs for both the platform and the content, also supporting in the deployment
Focal company's domain expertise	Offering industry specific assets, such as telco specific dummy training data sets to support development	Offering telco industry know-how in the form of the platform and the content for sales partners
Factors related to direct network effects		
Social and community	A vivid developer community can be an essential factor	Not identified
Sharing based approach	The more there is content available for use as building blocks for new content the better	Not identified

Focal platform ecosystem attraction factors that apply similarly to both development and sales partners. Certain attraction factors could be considered to attract partners similarly to the focal platform ecosystem regardless of whether a development or sales partners is in question. Five of these were identified: provision of a transparent roadmap for partners, attractive business framework, the brand of the focal company and the platform, indirect network effects and finally marketing the platform ecosystem to partners.

First of all, a transparent roadmap of the focal platform's future has to be available for the partners to be attracted to participate in the platform ecosystem. It is often a significant decision for a partner to choose to participate in a platform ecosystem of this scale, either by contributing to the development of the complementary content or by selling the platform and the content atop of it. The director of digital platforms from a potential ecosystem partner company put it: *"Our first consideration in deciding the platform for our analytics and our customer's analytics needs is its future prospects. If we are not convinced that the platform will be developed and supported far to the future, what would be the point of jumping aboard? There is always an investment associated with committing to technology such as [the focal platform name] and when making these decisions, we have to take a longer-term perspective."* Thus, describing the history and the current use of the platform will not be enough to attract partners. The direction for the future must also be convincingly communicated to them.

The schedule for the planned future for the platform is among the most important factors in the roadmap that the potential partners are looking for. When partners compare their alternatives with technologies such as the focal platform, they are not focusing on merely the current situation as said, but they also consider the upcoming changes. The timeframe within which the improvements or changes to the platform or its ecosystem are due is considered a central factor as well. It matters if the platform seems to be gaining a technical edge over the competition within a particular timeframe or if the schedule suggests that it will fall behind. A transparent schedule for the platform and its ecosystem will provide grounds for the partners to also plan their business. The vice president of sales from a potential ecosystem partner company stated: *"The roadmap would need to feature a constantly updated timeframe so that partners could also plan their business around the platform."*

In addition to a schedule that will outline the fundamental changes, the potential partners would like to understand the role and commitment of the focal company in the platform ecosystem. The director of digital platforms from a potential ecosystem partner company also claimed: *"As [the focal platform name] is currently primarily leveraged in-house a key consideration for our participation would be the commitment and the role that you [=the focal company] would play in the ecosystem. If we can see that you are committed to utilization and the development of the platform, in the long run, it increases our confidence."* The role of the focal company is also important in terms of how significantly it aims to control the complementary content space. If the focal company prioritizes the long-term success of the focal platform as a keystone construct, it should aim to have the best possible content in the platform regardless of whether it is developed by it or by a partner. On the other hand, if the focal company's complementary content business is the priority over the platform, then it could try to protect some of the content categories by enforcing stricter control on the partner access. This choice should also be transparent to the partners. Thus, communicating the future aspects with a schedule, signaling strong commitment and indicating the focal company's role in the ecosystem in a transparent way, will be a significant factor in attracting partners.

In the increasingly fast-paced world of today, the importance of a clear business framework that allows low bureaucracy for partner participation to the platform would also be an important attraction factor. The interviewed offering management responsible said: *"Providing a simple and standard legal framework is mandatory for the more open ecosystem type of approach, in which there would be multiple partners in a more flexible manner. Currently, if we are considering partnering with someone, the process to get over the bureaucracy can take months, and some of the smaller players cannot even afford the legal hassle. Making this process lighter will help us greatly in attracting partners."* Also, it would help the focal company if the contractual process would be streamlined, since considering involving dozens or hundreds of various partners in the ecosystem would not be feasible without an improved process. For the partner, a "plug-in and play" type of contractual and legal approach will also be attractive as it lowers the barrier to join and start conducting business.

In addition to the clarity and simplicity of the legal and contractual terms, the perceived fairness within the platform ecosystem is a central part of the business framework. In ecosystem business, the partners should be respected and cared for by default, even though due to its size the focal company could dominate the terms of business with many partners to its short-term favor. However, having a short-term focus, should not be the way to go, as also discussed in regard to the roadmap for the platform. If the partners are satisfied, feel respected and can conduct their business in a fair manner, they will not be looking for an alternative and could also act as promoters to other potential partners. The interviewed change management responsible stated: "*In certain businesses, the short-term gain is basically all you have to think about, and you use your leverage everywhere you can. However, when you want to attract partners, you need to treat them with the utmost respect, care for them and provide them with fair opportunities.*" Thus, partners will be more likely to join a platform ecosystem with an attractive business framework. This means that the contractual and legal framework is clear, and the business environment is fair, providing the partners with business opportunities through which they can prosper without excessive bureaucracy.

In addition to the roadmap and the attractive business framework, also the brand of the focal company could be leveraged in attracting partners, especially within the telecommunications industry. The focal company is among the leaders in its industry, and the platform has gotten great publicity having many analysts praising it as industry-leading. Obviously, this could be leveraged in the partner attraction. The sales manager from a potential ecosystem partner company stated: *"Many companies would be thrilled if they could be recognized as members of your [=focal company's] ecosystem. They know how big you are, and they understand the business opportunities for them.*" Similarly, the offering management interviewee assumed: "*Our brand is among the key aspects that could attract both development and sales partners. A lot has to do with the ethics that we have cherished as a company. It signals trust to partners.*" The scale of the business as well as the trust that the brand signals to the partners could thus provide a solid foundation for the attraction of ecosystem partners. The branding could also prove beneficial the other way around, as discussed in the potential benefits of the interventions to the focal company. If high-profile partners would become part of the platform ecosystem, that could further attract partners as well as increase the platform's status in the eyes of the end-customers.

Finally, the indirect network effects, especially in model 3, in which both the development and go-to-market dimensions would have been opened up, could have significant attraction momentum. As the expansion mechanism for the development dimension suggests, the beneficial outcomes to end-customers follow from development partner attraction and their content contributions. In the same way, the sales partners would be significantly more attracted to a platform that has a great variety of high-quality content from a development ecosystem. Thus, the more there are development partners, the more attracted the sales partners could be. Similarly, the more there are sales partners, the larger the reachable market could be for the development partners' content and thus, they would be more attracted to join. The interviewed portfolio management responsible commented on the network effects: *"The reselling partners could be attracted by a very competitive offering that would be enabled by having a large pool of development partners and also vice versa! There are clear network effects in question and the activity on either development or sales dimension will much define the attractiveness in the other."* Even though for some smaller development players, the focal platform could provide a tremendous go-to-market channel even with only intervention 1, the model 1 does not provide similar potential for indirect network effects as model 3. This is due to the go-to-market dimension remaining closed and the sales are only conducted by the focal company without having a digital sales portal for the content. Being able to leverage the indirect network effects to the full extent within this field would require both of the interventions to be carried out.

In order to have an effect, all of the discussed partner attraction factors would need to be communicated to the potential partners. Whereas some of these partners could have reasonable visibility to the actions of the focal company, many do not. Thus, to attract these partners, there needs to be active marketing. In order to be successful in the ecosystem building, the importance of marketing should not be underestimated. The consultant industry expert said: "*When a company starts to build an ecosystem around this type of platform, it is quite common that as much as 50% of the total investment goes into marketing the platform to potential partners. Many different approaches can be applied, but for example, having a presence in the industry events or hosting own events for the partners are quite common ones.*" The analyst industry expert had a quite similar view: *"To attract a large*

number of partners, you [=the focal company] need to be very active on the marketing front. The events arranged by the largest public cloud platform providers, such as AWS, could be a good place to gain visibility to some of the potential partners." Thus, any of the discussed attraction factors cannot be considered to be a silver bullet that solves all the problems. There is still considerable effort associated with gaining the attention of the potential partners and communicating the presented attraction factors to them through marketing.

Table 10, focal platform ecosystem attraction factors that apply similarly to both development and sales partners

Factor	Description	Partner's point of view
Transparent roadmap	Describes the direction of the platform, schedule for the future and the focal company's role and commitment to it	Reduces the uncertainty for the partner to commit to the platform
Attractive business framework	Fair and simple contractual and legal environment to enable straightforward business	Low bureaucracy and fair business opportunities
The brand of the focal company and platform	A strong brand especially in the telecommunications industry	Brand signals trust and scale to partners
Indirect network effects (model 3)	The more there are developers bringing content, the more valuable the platform is to the end-customers and sales partners. Also, vice versa	The value increases as the number of players on the other side grows
Marketing the platform to potential partners	Marketing efforts in order to increase the visibility of the platform among potential partners	Gaining an understanding of the potential opportunities associated with the focal platform

4.4.2 Requirements for the focal company to enable a platform ecosystem

The attraction factors, as well as enabling the partners to contribute to the platform ecosystem efficiently, poses certain requirements to the focal company. These requirements are addressed here in four parts. First, in order to attract and manage the partners as well as ensure their capability to contribute, the focal company needs to form an ecosystem and partnership management unit. Second, the expansion of the platform ecosystem and the introduction of the partners also inflicts technical stress on the platform, and thus, there are certain technical requirements to be addressed in the process. Third, if a sales portal or marketplace would be introduced to support the go-to-market for the complementary content, it would also have particular requirements. Finally, the platform expansion will require patience and committed capital to be successful.

Ecosystem and partnership management unit. It would not be realistic to consider that the attraction, enablement and management of a partner ecosystem would take place without specifically allocating resources into it. Thus, a critical requirement for either of the interventions would be to set up an ecosystem and partnership management team. The analyst industry expert commented on the issue: *"You must create an ecosystem and partnership team that can host and manage the ecosystem as well as also look into the potential partners."* Based on the attraction factors and the ecosystem management needs identified in the interviews, the unit should have two branches: the partner lifecycle management team and the partner enablement team. The former would concentrate on the ecosystem building and management while the latter would enable and ensure partner productivity.

The partner lifecycle management team would concentrate on five key areas, based on the identified capabilities and processes needed in partner management. These were provided among other by the analytics development responsible, offering management responsible and analytics sales responsible. The analytics development responsible suggested: *"We need to have the following ecosystem management capabilities in-house: partner attraction, engagement and evaluation."* While, the offering management responsible implied: *"partner acquisition, development, evolution and retirement are key capabilities in managing an ecosystem. Multiple companies can be benchmarked in their partner lifecycle management."* And the analytics sales responsible commented: *"Regardless of how open*

model we end up hosting, our business and the data we deal with are sensitive and there needs to be some sort of partner qualification process. However, it should be as light as possible so that it does not seem too tiresome towards the partners and does not consume too much of our resources."

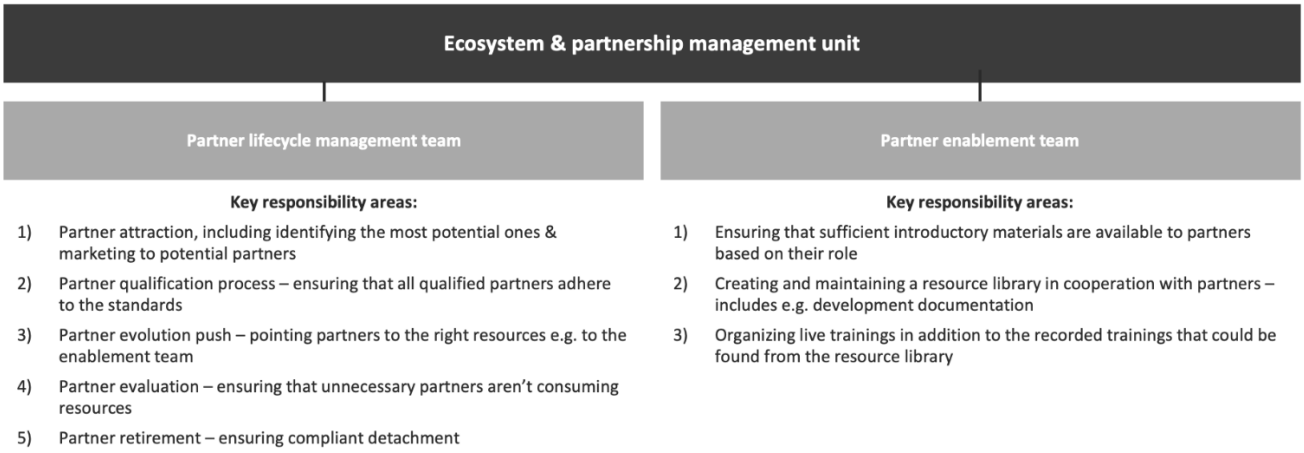

Figure 9, ecosystem and partnership management unit structure and key responsibilities

The first area of responsibility for the partner lifecycle management team is the partner attraction or ecosystem building. This means that the team is responsible for marketing the platform to the potential partners as well as identifying the most prominent partners to invest in to get them aboard. Following the attraction, the team would also be responsible for the qualification process, which ensures that partners adhere to the standards of the focal company, especially in terms of security. The delivery management interviewee explained: *"There will be a need to take additional measures to ensure that the potential partners adhere to our strict security standards.*" Third, the team would make sure that the partners are equipped to find the resources they need in order to contribute. Primarily this would mean that the partners would be pointed to the partner enablement team. The fourth responsibility area considers the existing partner evaluation, which is essential if there is a significant investment to partners, for example, by providing them with a free sandbox development environment. If the partners are not active but are still consuming resources, they should be retired from the platform. This process should be transparent, and the partners should know beforehand what the terms are to gain the privileges so that there will be no negative surprises. The final step in a partner's lifecycle is the

retirement, in which the team makes sure that no security or compliance issues will follow. This means that the partner will not use any privileged assets outside the platform.

The partner enablement team, on the other hand, is responsible for making sure that the involvement for partners is extraordinary as well as that they have the resources to develop their productivity and contributions over time. It would have three key areas of responsibility. First, the team would make sure that introductory materials would be available for partners in order to have an effective start and learning process. This is among the most crucial phases in terms of ensuring partner attraction and retention, since if the initial experiences are poor, the partners will not likely continue as the portfolio management interviewee suggested in regard to development partners: *"We need to make sure that the development experience is satisfactory as that will define the partner's willingness to continue with us."* Second, the enablement team will coordinate the resource library, which contains all the material and resources that can help partners in their work. This can also be done in cooperation with partners, especially in the development dimension, where a developer forum could be hosted for the community. Third, they will organize training and other events for the partners that will boost their learning and capabilities to develop or sell efficiently. The strategy and portfolio management responsible implied: *"We need to have resources to host training events and courses for partners. This way we can also make the ecosystem tighter."* If the events are recorded, the recordings should also be made available to the resource library that the team coordinates. Thus, the enablement team's role is less in the management of the partners and more in their support and enablement. However, it is not a technical support team, even though it could eventually document the technical support tickets for others to find a solution to a particular issue.

Technical requirements. In order to proceed further with either of the interventions, two technical issues should be addressed: the platform's service level agreements (SLAs) and customer data unity. The platform SLAs that define for example the agreed minimum availability of particular platform functionality, such as storage, have to be also maintained in a scenario, which would involve a monumental increase in the platform's use. This means that the technology must scale with the potentially increasing utilization of the platform. The SLAs would have to be competitive in the market

and they should be transparently communicated to partners. The delivery management responsible explained the requirement regarding SLAs: *"If we allow partners into the ecosystem, for example, allow sales partner to handle the deployment of the platform and implementation of the content to the end-customer, we need to have competitive SLAs in place. The partners need to know what they are getting."* The SLAs are the focal company's promise to the potential platform ecosystem participants on the standards that they can expect to get from the platform.

Second, to provide more potential for standardized content and self-service, especially with a sales portal or a marketplace, there is still some work to be conducted in the area of end-customer data unity. A special characteristic in the telecommunications industry is highly complex network structures, due to multi-vendor and generation networks, which have not in all cases been integrated carefully with each other. Thus, for example, running content dedicated to network availability analytics on the platform would require some modifications to the content from case to case to work with the customers' unique data structures. The strategy and portfolio management responsible said: *"Before we should consider bringing partners on board, we should advance a bit further on creating methods of unifying end-customers data between different cases… Some system integrators could be able to help us with the data harmonization."* Thus, even though this could likely be something that should be solved before launching either of the interventions on a larger scale, considering partnering up for this challenge could also be smart.

Additionally, the focal platform should provide data dictionaries for partners so that they could make sense of customer data. The offering management interviewee explained this: *"We also need partners who are not experienced in the telco industry. Especially in terms of development partners, we would have to provide data dictionaries for them, so that they would understand the data. Taking this further, we should provide buckets and categories for the data in relation to the potential content they could develop so that partners can associate certain categories of data with certain applications."* The data is the fuel in the field of the focal platform but working with it is not trivial. Advancements with these data-related issues will help the focal company even without either of the interventions. Solving them is, however, extremely important for supporting those partners who would contribute to the

telecommunications customers without previous exposure to the industry. If not addressed accordingly, these issues could become barriers to the expansion of the platform ecosystem.

Sales portal or marketplace requirements. There are three key requirements in implementing the sales portal or marketplace for the complementary content and having the sales partners or in some instances the end-customers directly utilizing the content from one of them with their platform. First, the offering must be brought to the digital sales portal or marketplace. The content brought there must feature a thorough description, a way to consume it as well as a clear pricing model. The analytics technical management interviewee also commented on this: *"In order to bring content to a marketplace, it needs to have clear enough descriptions for it to sell itself. This means crystal clear value propositions... We should be able to have consumption-based pricing on the content atop of the platform. This would make it easy for the consumer of the content to understand the price."* Consuming the content from the sales portal or marketplace by leveraging the focal platform requires that the content is specifically developed to be compatible with the integrated analytics, virtualization and automation technologies and tools of the platform.

Second, there needs to be a sufficient amount of self-serviceable content available for it to make sense to maintain the sales portal or the marketplace. The vice president of sales of a potential ecosystem partner company stated: *"To be truly valuable for the end-customer, there has to be a rich offering on the marketplace that the customers could utilize themselves directly from there by leveraging [the focal platform name]."* Having non-standard solutions available in a marketplace that cannot directly be consumed by the end-customer is not a problem, but the most value with a marketplace comes with content that can be self-serviced. The business strategy interviewee explained: *"We could have both the self-serviceable content and the services that need more tailoring in the marketplace side by side. The labels for the content that needs case by case tailoring would be more of an advertisement in the marketplace and end-customers could, for example, get the contact information of the provider for that particular content through the marketplace. Whereas the real value in a marketplace is in the strong self-service content that the end-customer could consume directly from there utilizing [the focal platform name] as the engine."* Having a variety of offering with at least some self-serviceable content

could be considered to be a requirement for the successful launch of a sales portal or a marketplace. This requirement concerns mostly the focal company but also development partners if they would be involved in the ecosystem.

Finally, if either the sales portal in model 2 or the marketplace in model 3 is implemented, they must also be marketed alongside the focal platform. The sales manager from a potential ecosystem partner company explained: *"End-customers could be really interested in a marketplace, through which they could immediately access complementary content to the platform. However, the marketing of the platform has to be thought thoroughly to increase awareness of it as a feature of [the focal platform name] and that would primarily be your [=the focal company's] responsibility."* Thus, the sales portal or marketplace would have to be brought to the attention of the different sides of the platform, but it could also act as marketing factor to further attract end-customers and partners to adopt the platform itself.

Patience and committed capital. Above all, the foundational requirements with the interventions are patience and committed capital. They are needed in order to allow the expansion mechanisms to result in the beneficial outcomes in both of the dimensions. Building an active platform ecosystem does not happen overnight and the return on the investment cannot be expected to be reached immediately. The offering management responsible explained this: *"Considering the opening of the boundary in either of the dimensions will not pay off straight away. There will have to be patience and committed capital."* Change through expanding the platform ecosystem was, however, considered necessary as discussed in the context section, but without the patience and willingness to invest, the change will not take place.

4.4.3 Evolutionary path

So far, the focus has been on identifying how the expansion mechanisms can be induced and enabled in both the development and go-to-market dimensions separately. However, it was identified that there would be significant potential for indirect network effects in model 3, in which both of the interventions would have been carried out. A specific route to mode 3 has not been discussed yet. In the context of

the focal platform, the interviewees almost unanimously claimed the intervention 1 to be a requirement to proceed with intervention 2. Meaning that the development boundary would be opened to the development partners before opening towards the consumption and involving the sales partners or considering a sales portal or marketplace for the complementary content. Two primary reasons for this order could be identified.

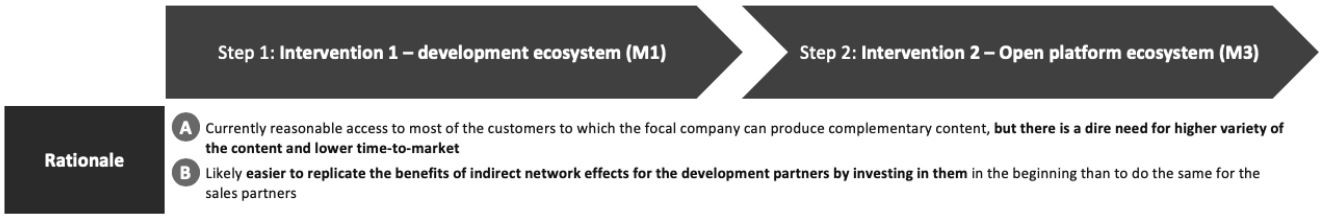

Figure 10, the consensus for the sequential evolutionary path of the focal platform ecosystem

First, the limitations with the variety and the time-to-market of the complementary content are currently seen as more substantial hindrances compared to the access to the end-customers, especially in the telecommunications industry. This means that the issues with the development dimension are more pressing and should be solved first. The analytics sales interviewee stated this: *"We are not missing engagement opportunities with customers, but rather missing content to deliver to them."* Also, the analytics development responsible backed this up: *"The lack in the variety of the [complementary content] offering is a more significant issue for us than not having the reach to the customers in the telecommunications industry."* However, the analytics development responsible continued: *"In terms of the adjacent industries we also lack some access to the customers as we do not have that strong existing contacts there and also, we do not have such an exhaustive understanding of those customers' needs."* Thus, especially when concentrating on the telecommunications industry, the expansion and opening in the development dimension should be considered first. For the adjacent industries, however, the difference is not that clear.

Second, the catch-22 problem with the indirect network effects could be more difficult to artificially solve for the sales partners than for the development partners. This means that it might be easier to attract development partners than sales partners without involving the other in the ecosystem. The main reason for this is that the development partners could likely be attracted, for example, by

providing them with development grants. With these grants, they would still have an incentive to develop. In the go-to-market dimension, no matter the investment and number of sales partners, nothing will be sold, if there is nothing to be sold. The current situation is obviously not this extreme with the focal platform, but still ramping up the development dimension was seen as more accomplishable without the changes in the go-to-market dimension than vice versa. The change management interviewee explained: *"We should definitely first build a compelling offering and only then consider opening up more towards sales partners and end-customers. With investment to the development partners, we could attract them aboard and actually get additional content for the platform, but without a richer offering, the sales partners could likely not be attracted."*

However, there was a voice also for the opposite order of implementing the intervention 2 and only then the intervention 1. The offering management responsible commented on the issue: *"The committed capital and patience required for a successful rollout of the development ecosystem without increasing the reach in the go-to-market dimension would likely be too much to expect in the current situation. We should first increase the reach towards customers to increase the revenue potential with the existing offering and then invest those spillovers into building the development ecosystem."* It seems to come down to the company's ability to take risks and wait for the returns on investment.

Even though the consensus was that the intervention 1 should be carried out before considering the intervention 2, there were also two interviewees who did not consider it necessary to roll the interventions out sequentially. At least not in the same order across the entire business. The cloud strategy responsible proposed that both the intervention 1 and 2 should be carried out simultaneously and thus move directly to the model 3: *"Opening up the development or go-to-market boundaries separately would not make sense as they do not individually generate the benefits of platform economy the same way as opening both simultaneously. The effort of, for example, creating a marketplace for all of the complementary content that partners could develop is quite small."* The analytics technical management responsible suggested that the order does not have to be the same across the board: *"We could open up the development dimension first in certain areas of business and the go-to-market first in others."* Thus, obviously a non-sequential approach could also be an option.

5 Discussion

This chapter discusses the results of the study, its practical and theoretical implications and its limitations. First, the results of the study – the designed artifacts – are described in section 5.1. The following section 5.2 proposes brief recommendations to the focal company based on the findings. Then, practical and the theoretical implications of the thesis are discussed in sections 5.3 and 5.4 respectively. After them, the limitations of the study are described in section 5.5 and finally, the thesis paper ends with concluding remarks in section 5.6.

5.1 The three design proposals for the expansion of the focal platform ecosystem

This thesis set out to explore the opportunities to expand the platform ecosystem of the focal technology platform by involving partners. The problem was approached employing the design science research methodology in association with the CIMO logic. The understanding of the context and background resulted in the formation of specific objectives for the solution. These two objectives of increasing the scope of the complementary content and the sales reach for the platform translated into interventions of opening the development boundary and the go-to-market boundary. The interventions were the foundation for the design of the three platform ecosystem models. However, the design of the artifacts was not ready at this stage as there was no firm understanding of their potential beneficial outcomes or the mechanisms of reaching them. These were also studied to fulfill the requirements of the CIMO logic. Thus, as characteristic of design science research, this study resulted in artifacts that could offer a solution to a real-world problem and would satisfy the objectives set for it. The artifacts of this research are the three platform ecosystem models. These artifacts also provide a solution to the research problem as well as answer the research questions, that were presented in chapter 1.

Table 11, the three designed proposals for platform ecosystem expansion

	Artifact 1 – development ecosystem (M1)	**Artifact 2 – sales ecosystem (M2)**	**Artifact 3 - Open platform ecosystem (M3)**
Context	Limited variety of complementary content due to scarce resources	Resource intensive sales processes and limited access to adjacent industries	Combination of artifacts 1 and 2
Intervention	Intervention 1: opening the boundary towards development partners to allow them to contribute to the complementary content development atop of the platform	Intervention 2: opening the boundary towards the consumption and involving sales partners as well as implementing a sales portal for the focal company's complementary content	Intervention 1 + intervention 2 with marketplace for complementary content
Beneficial outcomes	**End-customers:** increased variety of available content and improved utility	**End-customers:** improved utility	**End-customers:** combination of artifacts 1 and 2
	Focal company: improved customer loyalty and acquisition through partner capabilities and capacity, improved future prospects	**Focal company:** increased sales reach, capabilities through partners, efficiencies through sales portal or marketplace	**Focal company:** combination of artifacts 1 and 2
Mechanism	**Development dimension expansion mechanism**: 1) attracting development partners → 2) partner developed content added → 3) beneficial outcomes	**Go-to-market dimension expansion mechanism**: 1) attracting sales partners and opening a sales portal for complementary content → 2) sales partners conduct sales and sales portal utilized by end-customers and sales partners → 3) beneficial outcomes	**Evolutionary path**: intervention 1 → intervention 2, both expansion mechanisms exist Additionally, indirect network effects between development partners and sales partners or end-customers can strengthen the expansion mechanisms

Artifact 1 – development ecosystem (M1). In the current situation, the complementary content is primarily developed within the focal company. While studying the context, it became apparent that it had certain limitations that should be addressed. First, there are limited resources in the complementary content development, that forces the focal company to concentrate only on the highest revenue potential content. This leaves a variety of customer needs unserved and thus also limits the value of the platform to the end-customer. Second, the focal company has a greater need for AI and data science capabilities in the content development, than what is currently available. Finally, the capability to produce content to the adjacent industries outside of telecommunications is also limited.

The presented issues contributed to the intervention 1, which proposes the opening of the development boundary towards development partners to allow them to contribute to the complementary content creation atop of the platform. When considering the current situation (M0) as the starting point, the intervention 1 translates into the design of the first artifact, which is the development ecosystem (M1). The beneficial outcomes of successfully carrying out the intervention 1 would aid with the identified contextual issues and provide an enhanced situation for both the end-customers of the platform as well as the focal company. For the end-customers, the most significant benefits would be related to the increased variety of complementary content as well as the utility. They could utilize more exhaustive offering of complementary content through the platform, potentially leading into a situation, where they could satisfy all of their analytics, virtualization and automation needs through the focal platform. For the focal company, these customer benefits would improve new customer acquisition and retention as well as provide the foundation for a more secure and prosperous future in the upcoming era of 5G.

The development dimension expansion mechanism was introduced to depict the mechanism through which the beneficial outcomes could be expected to be reached. In order to have partner developed content, the partners would have to adopt the platform and be attracted towards it. Many of the platform adoption elements that were found from the existing literature also surfaced in this research, but there were also ones that did not come up in the literature review. The financial aspects in terms of the platform acting as a sales channel (Ceccagnoli et al. 2012; Kuebel et al. 2015) and partners being

attracted by the sales and profit potential (Koch & Kerschbaum 2014; Song et al. 2018) were also identified in the empirical part of this research. Also, the enablement and technology aspect that was identified in the literature review was considered an essential aspect by the interviewees in the attraction of the development partners. High quality toolkit, instructions and technological leadership were found to attract development partners similarly to the Koch and Kerschbaum (2014 and Song et al. (2018). Also, the possibility to multi-home content was found to be a potential attraction factor in the interviews as well as in the literature (Hyrynsalmi et al. 2016). Finally, the social aspect for the development partners in the form of a developer community also came up both in the literature (Van Antwerp & Madey 2010; Hinds & Lee 2008) and the empirical part of this research.

However, there were also differences. Surprisingly, the involvement of the focal company in the complementary content development was not brought up as a factor that could affect the development partner attraction in the case of the focal platform. Cenamor et al. (2013), on the other hand, noted that substantial participation and control by the 1st party might decrease the adoption of a platform within potential partners due to fear of monopolistic behavior. The reason why this did not come up, could be that the interviewees potentially saw large enough gaps in the complementary content offering that the competition between the focal company and potential development partners would not be extensive in the short-term. This assumption would, however, assume that the partners would develop and bring the content that would address those gaps, rather than bringing directly substituting content, that could induce a defensive reaction from the focal company. In fact, the complementarity between content on the platform, was found to be an attraction factor in this research for development partners. Especially this would be the case if some of the content could be used as building blocks for new content. Also, Parker and Alstyne (2018) emphasize that the speed of innovation can increase through this type of exploitation of other platform participant's content.

Artifact 2 – sales ecosystem (M2). The sales of the platform and the complementary content are currently carried out by the focal company, in a traditional project by project manner, which consumes a substantial amount of resources. Additionally, while the company has access to the end-customers in the telecommunications industry, that is not the case in the adjacent industries, such as transportation,

due to not having an established brand or existing customer relationships in there. Thus, by changing the go-to-market approach, there could be potential for increased efficiency and reach.

The intervention 2 was formulated as the answer to these challenges. Intervention 2 proposes the opening of the boundary towards the consumption and involving sales partners as well as potentially a sales portal or marketplace type of approach in the go-to-market dimension. When considering the current situation (M0) as the starting point, the intervention 2 translates into the design of the second artifact, which is the sales ecosystem (M2). The beneficial outcomes identified with the intervention 2 could address the issues with the current situation. Even though the end-customers were considered to benefit more from the intervention 1, there were still some utility-related benefits also identified with intervention 2 for the customers. Customers could access the platform and the complementary content through their trusted reseller, which they could prefer. Also, efficiency and convenience in the purchase and consumption process could be superior with a sales portal or a marketplace for the complementary content, especially with self-serviceable content. On the other hand, the focal company could benefit by reaching a larger pool of end-customers for the platform and complementary content through sales partners. The sales partners could have capabilities and expertise that could help in serving larger and more diverse group of customers, such as value proposition formulation and deployment of the platform for end-customers. Also, creating a sales portal for sales partners and end-customers to access the complementary content from, could improve the sales efficiency for the focal company and thus reduce the required resources in that regard.

The go-to-market dimension expansion mechanism describes how the beneficial outcomes with the intervention 2 could be materialized. In terms of the sales partners, the outcomes cannot be reached unless the partners are attracted. Similarly, to the attraction of the development partners, the financial attraction factors were found to be central in the attraction of sales partners. Instead of the platform providing a sales channel, the sales partners are primarily attracted by the access to the platform and the complementary content to sell, since this can provide them with more sales opportunities. The enablement and technology-related aspects were also found valuable, and the easier it is for the sales partners to sell and the more they can get support, the more they should be attracted to the platform.

While the development partners could also find attraction in factors induced by the direct network effects, namely the developer community and sharing of content that can be employed as building blocks for new content, this type of attraction factors could not be found for the sales partners. Thus, the sales partners would likely prefer as small sales partner ecosystem as possible, since that would keep the direct competition low.

Artifact 3 – open platform ecosystem (M3). The artifact 3 results from carrying out both interventions, when starting from the current situation (M0). Thus, it is a combination of the first two artifacts. It provides solutions to the issues in the current situation in both the development and go-to-market dimensions and has the potential to offer all of the beneficial outcomes associated with artifacts 1 and 2. In addition, it also provides significant potential for indirect network effects between the sales and the development sides. This can be a significant attraction factor for both the development and sales partners. Also, with a marketplace approach, the end-customers could directly consume some of the content, and the indirect network effects could be formed between the development partners and end-customers. This would require self-serviceable content and would cut out the traditional sales from the process, potentially improving efficiency and convenience. Basically, model 3 would also meet the definition of a true multi-sided platform (Hagiu & Wright 2015). It could allow direct interaction between different sides on the platform, while still having all of them affiliated with it.

The transparent roadmap for the platform ecosystem's future provided by the focal company as an attraction factor for both development and sales partners was an interesting finding in the research. It would be necessary if either of the interventions would be carried out separately, but obviously also with the model 3. However, it emphasizes the information flow from the focal company to the partners, but not the other way around. Bidirectional interaction or feedback from the partners towards the platform owner did not come up in the interviews apart from the aspect of technical support. I would argue that the reason for this is that the ecosystem thinking may have been a rather novel concept for many interviewees, as they may be more accustomed to traditional supplier-buyer relationships.

However, for example, Ghazawneh and Henfridsson (2013) suggests that feedback from the partners is also an important factor in the development of the platform, making the case for the boundary resources. In their study of iPhone, they note that Apple listened to the criticism from the application developers and made changes to, for example, iPhone's SDK to promote the developer diversity. I believe that a bidirectional discussion is critical with any of the proposed artifacts of this study, in both attracting and retaining partners but also in enabling them to be able to contribute as efficiently as possible. It will provide them with sensation of being able to have an impact on the platform's direction as well as will likely result in useful improvements to the core platform technology. Thus, I would propose that the partner enablement team within the ecosystem and partnership management unit would also be responsible for intermediating bidirectional discussion between partners and the technical platform core development and maintenance organization. This would allow the development and sales partners to communicate their and their customers' suggestions for improving the platform. This should also be carried out independently with either of the interventions, if the model 3 would have not been reached yet. From the focal company's standpoint, this practice would not only signal commitment to the platform like the roadmap but also imply commitment to the partners and their business in the platform ecosystem.

The research suggested that in the context of this study, the artifact 3 should be achieved step-wise, by first reaching artifact 1 and then artifact 3. In other words, the intervention 1 should be carried out before the intervention 2 in the case of the focal platform. There are two primary reasons for this. First, the focal company is considered to have good access to CSP customers, whereas even with them, there would be a need for an increased variety of complementary content. Second, the power of indirect network effects is considered to have prominence in attracting partners, and it should be easier to replicate the benefits of the indirect network effects to the development partners than to the sales partners. This would require investing in the development partners, for example, by providing direct development grants, but the platform would still be able to get something directly from that investment. Whereas, if there were investment in sales partners to attract them without the existence of sufficient complementary content, they would not bring any additional value. The shortcoming of this approach, in terms of network effects, would be that developers might also be attracted by factors

deriving from direct network effects, such as the developer community. Thus, especially in the beginning the investment might be substantial to get some of the first development partners aboard.

5.2 Recommendations to the focal company

Based on the study and the designed artifacts, I provide concise recommendations to the focal company. This is a shortened and adapted version of the recommendations to avoid unveiling business sensitive information. The recommendations feature the following five consecutive steps:

1) **Set the goal to model 3 and aim to reach it through model 1.** Conduct a financial feasibility study, that analyses the revenue potential and the required investment for model 1 in shorter term and for model 3 on the longer run. Leverage the understanding of the beneficial outcomes and the expansion mechanisms in the feasibility study. Proceed forward, if the evolutionary path seems financially viable, capital can be committed and there is sufficient patience within the leadership.
2) **Invest in the partnership and ecosystem management unit and form a solid roadmap.** The current organization does not have the resources to take on the partner lifecycle management and enablement, meaning that a specific unit has to be set up for it. This does not mean that the unit has to be extensive at first, but it should rather be gradually grown along with the platform ecosystem's expansion.

   Additionally, the focal company should form a roadmap to signal the anticipated future of the platform and the ecosystem. This will result in increased partner confidence, as they understand the commitment of the focal company as well as the direction for the platform ecosystem in the future. The roadmap should also imply the role of the focal company in the platform ecosystem. This requires the company to indicate whether it aims to prioritize the success of the platform over its own complementary content business or vice versa. If the platform is prioritized, then it should ensure that in each content category, the best possible content is present regardless of whether it is developed by it or a partner. If, however, the company's complementary content business is prioritized, it could protect its content from substitution by enforcing stricter control of partner access. Prioritizing the platform over the complementary content business could result in improved

partner attraction due to partners conceiving the focal company as more of an enabler than monopolistic competitor in the platform ecosystem.

3) **Conduct pilots with model 1 and iterate the approach if the expected results are not received.** In order to validate the findings of this research as well as the results of the financial feasibility study, model 1 should be piloted, for example, with a limited number of hand-picked development partners. These partners could, for example, address some of the gaps in the content within the telecommunications industry. Thus, the telco specific ISVs and even some of the more advanced CSPs could be interesting partners in the initial phases. It would also be important to involve some of the non-industry specific development partners, so that the requirements and practices with the telecommunications specific assets, such as data sets for AI and analytics model training, could be tested and improved to attract and accommodate a wider partner pool. If the pilots do not have the anticipated results, then iterate the approach.
4) **Expand to model 3 once sufficient scope of complementary content offering exists with model 1.** Expand the development ecosystem further by leveraging the understanding of the partner attraction factors, if the results from the pilots seem promising and they validate the findings of this thesis as well as support the financial feasibility study. When the complementary content offering seems competitive enough, start attracting sales partners into the platform ecosystem by leveraging the attraction factors identified in the study. By doing this, the expansion to model 3 takes place and also a larger scale expansion into adjacent industries might be a viable undertaking at this point. Additionally, once there is a sufficient amount of self-serviceable complementary content made available by the development ecosystem, introduce a marketplace for the content atop of the platform. The content can then be directly utilized by the end-customers either with or without help from the sales partners.
5) **Expand the model 3 and maintain strong dialogue with the platform ecosystem.** Ensure that the partnership and ecosystem management unit has the resources to keep up with the growing platform ecosystem. This is essential, since their role is central in ensuring the satisfaction and productivity of the partners. Furthermore, emphasizing the bidirectional interaction between the partnership and ecosystem management unit and the partners will enable the development of the platform ecosystem even further as well as will signal commitment to the partners.

5.3 Implications to managers and other practitioners

There were two practical objectives for this thesis. First, it aimed to provide the focal company with an understanding of potential platform ecosystem models to implement, their beneficial outcomes and the mechanisms to reach them. Second, alongside the practitioners within the focal company, the aim was to also present relevant findings for professionals outside the company, who find themselves in similar situations in their businesses. This thesis delivered comprehensively on both of the practical objectives.

The thesis resulted in three platform ecosystem models that all reach one or both of the set objectives for a feasible solution that would strategically expand the platform ecosystem. These objectives for the solution were to increase the scope of the complementary content offering associated with the platform and increase the sales reach for the platform and the complementary content. The platform ecosystem models were designed employing the CIMO logic, and thus, the models provide understanding of four aspects. First, the focal company gains an objective view on the current situation with the platform and the related business through the conducted interviews and synthesis on them. Second, based on that context, potential interventions were defined, so that the resulting platform ecosystem models would meet the context-based objectives set for the solution. Third, the potential beneficial outcomes of the interventions and the models were described. Finally, the mechanisms to reach the beneficial outcomes associated with the interventions and the models were presented. Together, these all provide a solid understanding for the decision-makers within the focal company of the potential directions for the focal platform's evolutionary path. However, as described in the previous section, this thesis itself is not a sufficient study to begin implementing any of the proposed models. Even though the recommendations are based on an informed understanding of the situation, a stringent financial feasibility study will be needed to back up the proposed plan. This falls out of the scope of this research.

While this design science research concentrated on a specific B2B platform in the telecommunications industry, many companies can find themselves in a situation similar to the one in this study. As Moser et al. (2017) described, incumbents are currently aiming to transform their more conventional

businesses to follow the open platform business principles, that companies like Apple and Microsoft have been successfully employing. In this study, the proposed platform ecosystem models present these principles as they allow partners to participate in the development and commercialization of the platform and its complementary content. The interventions presented in this study, could on the abstract level be considered applicable to any situation, in which a product, service or technology can have something complementary attached or built atop of it, and it can be sold by a partner or through a marketplace. However, the context could differ greatly, and for example, the customer needs could be less variant from each other and a strategic partnership with one development company could complete the complementary content offering. In this case, the intervention 1 would still conceptually provide a solution to such a situation, but the extent to which it would be carried out to would differ.

The identified beneficial outcomes from the interventions could provide practitioners with a more complete picture of what they could expect to gain by implementing them. Obviously, some of the benefits, such as the 5G future survival and success for the focal company, would not be relevant to the same extent within other industries. However, if another industry was facing significant change, even this item could be generalized and considered that a platform owner would be protecting its future by having an ecosystem around the platform to answer to the changing needs of the customers. Thus, I would argue that the beneficial outcomes could be generalized quite widely to cover similar situations, in which a company is considering allowing partner access to its platform. However, the significance of the benefits will differ between cases. Finally, the expansion mechanisms themselves should provide practitioners with a sufficient view on how the beneficial outcomes could be achieved through the interventions on a general level. The outcomes cannot be reached unless the partners are attracted, and they contribute in a hoped manner.

However, the attraction might differ significantly between cases. I would argue that the attraction factors identified in this study would apply to many technology platforms, which require investment and learning from the participants in order to be able to contribute. Thus, in addition to considering the potential upside for the partners, the platform owner also has to consider how to minimize the cost and time for them to become productive. On the other hand, with some platforms, the partners will

put more weight on the potential upside, that the platform can provide them with. For example, producing protective covers for smartphones only requires the cover manufacturer to figure out the physical dimensions of the device and define the material for the cover. While the cover manufacturer will likely have to invest in production facilities, there is comparably little that the smartphone producer, the platform owner in this case, can do to, for example, educate the cover manufacturer. This means that the platform owner does not have to consider the enablement for the partner through training and documentation in the same way as an owner of a high-technology platform such as the one in this study. Thus, attracting partners could vary significantly due to different industry dynamics and platform owners should aim to understand the key drivers in their context. As a general note, I would claim that the more complex the platform and the complementary offering is, the more the platform owner will have to consider how it can minimize the cost and time for the partners to become productive in terms of attraction.

5.4 Theoretical implications and future research

Two primary theoretical objectives were set for this thesis. The first objective was to provide a comprehensive review of the existing literature on the topics relevant to the study. The covered topics in the literature review were platform economy, digital platforms and infrastructure, platform openness, platform and business ecosystem evolution and lastly platform adoption. These provided an understanding of the current state of the literature as well as supported the empirical part of the research.

The second objective was to contribute to the platform ecosystem literature. The thesis accomplishes this in two areas, especially within the context of the study. First, the thesis describes potential beneficial outcomes of expanding a platform ecosystem by involving partners to it. This thesis provides a detailed view on the potential outcomes in the studied case, but as described in the previous section they will also provide an indicative view on the beneficial outcomes that could be expected in other similar situations to the end-customers of the platform as well as to its owner. With the beneficial outcomes, this study builds among others atop of Parker and Alstyne (2018), who discussed open platform approach's benefits to innovation. Second, this thesis introduces self-enforcing expansion

mechanisms for both interventions. The mechanisms share the self-enforcing characteristics of the innovation, adoption and scaling mechanisms of digital infrastructure introduced by Henfridsson and Bygstad (2013). Thus, this thesis also contributes to the literature in a similar way, by providing mechanisms for the expansion of the platform ecosystem in the development and go-to-market dimensions. An important part of the mechanisms is the attraction of the partners. This thesis provides a detailed understanding on the partner attraction factors as well as other requirements for the mechanisms to result in the beneficial outcomes in the context of the study, and thus also contributes to the investigation of platform adoption (Koch & Kerschbaum 2014; Kuebel et al. 2015; Song et al. 2018). The partner attraction contributions should be somewhat generalizable at least in the high-technology context, where the platform owner can through its own actions ease partners' journey to become productive in the platform ecosystem.

In addition to the two objectives, the thesis also set out to validate the feasibility of the design science research methodology in strategic research focusing on platform ecosystem expansion. The idea of employing design science research methodology emerged as the study is resolutely forward-looking and is based on a real-world context. Before locking down to it, the foundational suitability to this type of research was confirmed from a couple of academics familiar with the methodology. Additionally, the literature supported the use of design science also in strategic research as long as clear artifacts could be designed as a result of the study (Hevner et al. 2004; Peffers et al. 2007). In retrospect, the methodology was the right choice for this research. It supported the forward-looking nature of the studied phenomenon and allowed to provide the focal company with actionable results, while simultaneously complying with the academic standards and procedures.

Had it been possible, I would have, however, introduced two alterations to the employed research process. First, to allow a more iterative process, I would have interviewed the same people multiple times. For example, interviewing five carefully chosen individuals four times each could have resulted in more refined artifacts. Also, conducting these interviews in groups could have triggered exciting discussion, especially if the interviewees had different backgrounds and roles. Second, even though applying the CIMO logic allowed to cover the potential outcomes and mechanisms to reach the models,

the validity would have increased if the models could have been implemented in reality. This type of thesis research has particular time-wise limitations, but when studying something that could take less time and resources to implement, the timeframe of a thesis could be enough. In conclusion, I would encourage others to employ the design science research methodology in their strategic research, especially when the study concentrates on a forward-looking, real-world phenomenon. If possible, I would recommend trying to implement the two items described above, but even if not applicable, the methodology is still viable.

This thesis opens up interesting future research avenues. In particular, two avenues would be highly intriguing. First, since many companies find themselves in a similar situation that this study focuses on (Moser et al. 2017), carrying out research with the same focus on other industries could provide validation and fresh perspectives on the results of this study. This would bring more support to the generalizability of these results. As this study focused on a B2B context, conducting a study with a B2C platform could also bring valuable insights through, for example, potentially increased volume of transactions and smaller individual transaction size. Second, it would be interesting to conduct a study featuring multiple cases or summarizing multiple case-specific studies to understand how the different contexts affect the interventions, potential outcomes and the mechanisms. This type of research could allow the formation of patterns between certain types of contexts and proposed interventions as well as evolutionary paths. This should also be of particular interest to practicing professionals, as it could provide them with a more generalizable starting point in their considerations for the way forward with their business.

5.5 Limitations

This research naturally has certain limitations and those will have to be taken into account when considering the validity, reliability and generalizability of the results. This research followed a design science research methodology process applied from the widely referenced process by Peffers et al. (2007). As this research was a field study featuring interviews as the data collection method, the four commonly applied assessment categories presented by Gibbert et al. (2008) are applied to evaluate the

limitations of this research. The categories are construct validity, internal validity, external validity and reliability.

The construct validity refers to the accuracy of how well the research actually studies what it claims to study and it is related to the data collection phase (Gibbert et al. 2008). To improve the construct validity of the research, the thesis paper describes the chain of evidence from the initial research questions to the designed artifacts. However, the author's subjective view and background is always present and that can affect how the chain was constructed. Among other things, the author's limited technical background in topics, such as cloud solutions architecture, could have affected the focus of the interviews. The author reached a reasonable understanding in the underlying technical subjects with both the platform and the complementary content through courses and discussions with technical experts, but still there could have been some important technical aspects that were neglected in the study. However, this issue was aimed to be mitigated by interviewing both technically-oriented and business-oriented people to allow various views to emerge. Even so, the interviews could have still missed relevant issues either because some of the technical constructs were discussed on too abstract level or the interviewees did not mention something since it was not explicitly asked.

The causal relationships between variables and results are in the essence when assessing the internal validity of the research (Gibbert et al. 2008). Internal validity mainly concerns the data analysis phase and is related to how precise the fit is between observations and the resulting concepts (Smallbone & Quinton 2004). The conceptualization and categorization of observations into themes is subjective to the author's interpretation of the interviews. The risk of conceptualizing observations incorrectly is always present. The highest potential for internal validity issues is within the intervention design phase, which also resulted from some creativity of the researcher as typical for design science (Hevner et al. 2004). If errors were made in the context definition phase in terms of conceptualizing observations, they would have translated into poor basis for the intervention design. Additionally, during the analysis, some of the observations, especially in terms of the attraction factors, were categorized under themes that were already identified in the earlier research. This might induce issues in terms of internal validity.

To minimize the risk, the observations were not forcibly allocated under the themes found from the existing literature.

The external validity refers to the generalizability of the study across different settings than just the one, in which it was originally conducted (Gibbert et al. 2008). This thesis employed the design science research methodology and focused on the expansion of one platform ecosystem originating in the telecommunications industry. The designed artifacts are aimed at solving a specific problem in a specific context. Defining the generalizability of the proposed approaches in other settings would require an explicit attempt to conduct similar studies in other contexts or even preferably implement the proposed interventions in them. Thus, without additional research, speculating the generalizability any further than what has been stated in sections covering the practical and theoretical implications, would not be feasible. This is a clear limitation and should be taken into account when evaluating the findings of this thesis.

Finally, the reliability of the study concerns the absence of random errors, which would enable the subsequent researchers to reach the same insights, if they would conduct the study again following the same procedures (Gibbert et al. 2008). The reliability of the study was improved by providing a transparent view to the research process in chapter 3. Additionally, the replication of the study was enhanced by maintaining a database for all of the collected data, in this case, interview transcripts. However, as the thesis employed design science research methodology, which also requires creativity from the researcher (Hevner et al. 2004), the exact replication of, for example, the proposed interventions, could naturally not be guaranteed. Additionally, the interviews were semi-structured, which leaves some room for variability between the interviews based on the expertise and role of the interviewees. Thus, the data collection could probably also be difficult to replicate, even if the same questionnaire was employed precisely. These considerations reduce the reliability of the thesis.

5.6 Concluding remarks

This thesis employed design science research methodology to provide an understanding of the opportunities to expand a platform ecosystem, that originates in the telecommunications industry, by involving partners. A literature review focusing on platform economy, digital platforms, platform ecosystems, platform openness and platform adoption was conducted. An empirical part followed the literature review and resulted in the design of three platform ecosystem models. These models were based on the interventions that were defined as suitable to address the objectives of a solution that were derived from the studied context. To create a more complete understanding of the models, that resulted from the interventions, the potential beneficial outcomes of the interventions were studied alongside the mechanisms of reaching those outcomes. The models provide an understanding of how the focal company can strategically expand the focal platform ecosystem.

This thesis focuses on a topical subject as various incumbents are considering their opportunities to adapt to the widely successful business principles of open platforms. Primarily this means that they consider expanding their platform ecosystem to involve partners to contribute to the development and commercialization of their platforms as well as to the complements of those platforms. While the study concentrated on a single case, it also provides valuable insight to practicing professionals outside the focal company, who find themselves concerned with these issues. Additionally, this thesis proves the validity of a design science research methodology in studying a strategic topic, such as the expansion of a platform ecosystem in a forward-looking, real-world setting.

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Appendix

Appendix A, the interview guide for the 1st wave of interviews (slightly adapted version to avoid sensitivity issues)

Introduction

- The structure of the interview
- Introduction and background of the topic and the thesis (few introductory slides)
    - Presenting the objective of the study of exploring the expansion of the focal platform ecosystem
    - Ensuring that the understanding of the basic fundamentals of the current business was aligned between me and the interviewee

Questions: context and the current situation

- Do you believe that the focal company has the resources and capabilities to unleash the full value creation potential of the focal platform without involving partners? Why?
- What are the most significant challenges in the current situation with the platform and the business around it?
- What would have to be done to overcome those challenges?

Questions: potential partners to the platform ecosystem

- What type of partner companies should the focal company be looking for and what is needed from them?
- Why would a partner want to participate in the platform ecosystem?
- What are the key considerations in involving partners to the platform ecosystem?

Questions: vision and the future of the platform ecosystem

- What could be the benefits of expanding the platform ecosystem by involving partners?
- Summing it all up, where would you like to see the focal platform in 2 years?

Appendix B, the interview guide for the 2nd wave of interviews (slightly adapted version to avoid sensitivity issues)

Introduction

- The structure of the interview
- Introduction and background of the topic and the thesis (few introductory slides)
    - Presenting the objective of the study of exploring the expansion of the focal platform ecosystem
    - Presenting the interventions 1 and 2, as well as the resulting platform ecosystem models as a discussion material for the questions (see figure 4)

Questions: beneficial outcomes of the platform ecosystem expansion

- What would be the beneficial outcomes to the end customer?
    - With intervention 1?
    - With intervention 2?
- What would be the beneficial outcomes to the focal company?
    - With intervention 1?
    - With intervention 2?

Questions: mechanisms to carry out the interventions and materialize the beneficial outcomes

- Intervention 1:
    - How could the development partners be attracted to and enabled in the focal platform ecosystem?
- Intervention 2:
    - How could the sales partners be attracted to and enabled in the focal platform ecosystem?
    - What are the requirements of forming a sales portal or a marketplace for the platform's complementary content and having it utilized by the sales partners and end-customers?

Questions: evolutionary path

- If the goal was set to model 3, in which both interventions would had been carried out, should the interventions be carried out in a sequential manner or simultaneously?
    - If sequentially, what should be the order? Why?